Rock Products

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This Electric Dredge Digs 7000 Tons Daily

The "Elizabeth Pfeil," Recently Put into Service by the Iron City Sand Co., Is of New Type of Construction. Her Achievements Will Undoubtedly Be Noted by Many Other Producers Considering a Dredge of Similar Design

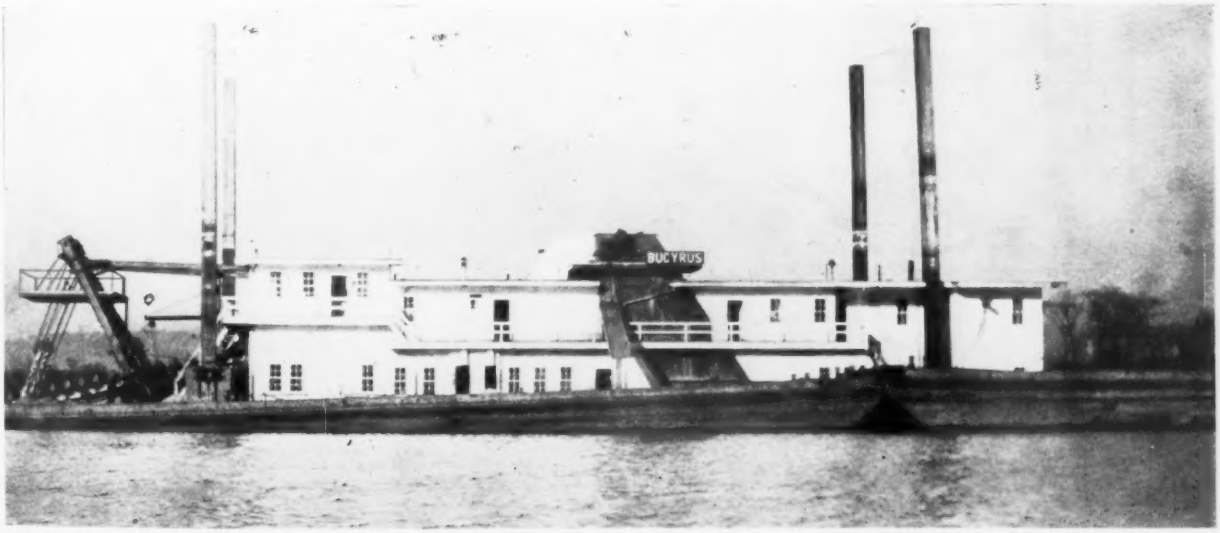
WHAT is said to be the largest all-steel, electrically-powered, ladder-type dredge employed in the recovery of sand and gravel in the United States, has been recently put into operation by the Iron City Sand Co., at Pittsburgh, Pa. This dredge, the "Elizabeth Pfeil," was constructed by the Bucyrus Co., South Milwaukee, Wis., and was launched from the Midland Barge Co.'s docks at Midland, Pa. It was built under the direct supervision of William Welch, erecting engineer of the Bucyrus Co., having seen service with this company in the construction of the Panama Canal.

Probably the most unusual feature of the dredge is its electrical operation. This type of power was selected because of the impure water encountered in the Ohio and other rivers on which the dredge will operate in the Pittsburgh district. Impurities discharged into the rivers by the steel and other mills in that district have been for many years the enemy of all river craft dependent on river water for boiler feed. The item of replacing boiler tubes has been a very high one in the operating costs; the Iron City company will now be relieved of that item by being independent of a river water supply.

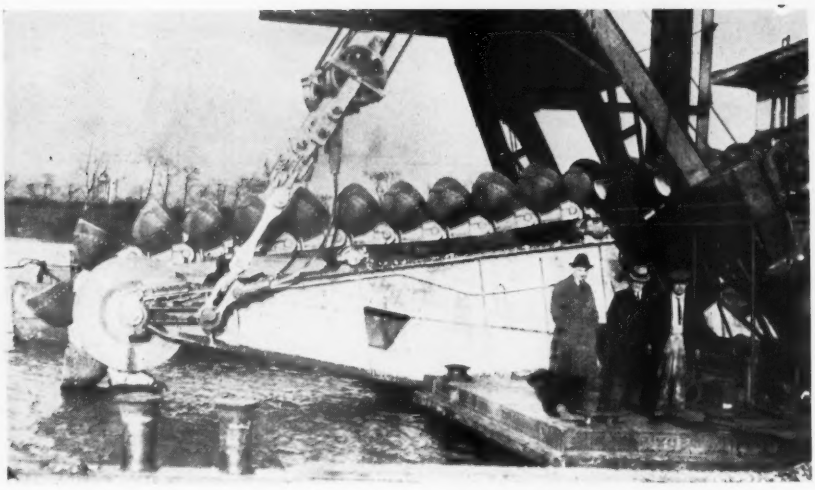
The chief power unit of the dredge is a 300-hp. Diesel type, four-cylinder, two-cycle, solid injection, oil burning engine. Although rated at 300 hp., the engine is capable of developing 450 hp. when running at its normal speed of 277 r.p.m. This engine, manufactured by the Worthington Pump and Machinery Corp., is direct-connected to a 270-kva. Westinghouse 60-cycle, three-phase, 440-volt generator which drives the machinery of the entire boat.

The installation of the power unit was supervised by Edward MacGregor, erecting engineer of the Worthington company, East Cambridge, Mass. Mr. MacGregor not only supervised the installation of the engine, but stayed aboard the dredge several months after it was put into operation for the purpose of seeing that the engine properly functioned.

This was accomplished by the use of a log sheet, taking readings hourly of amperes, volts, kilowatts, fuel oil and lubricating oil consumption, oil pressures, inlet and



The "Elizabeth Pfeil" at work on the Ohio river at Pittsburgh



The ladder and bucket line raised for repairs. Each bucket weighs 1500 lb. and the total weight of the ladder and chain of buckets is approximately 125 tons

outlet water temperatures, and the engine-room temperature.

Electricity for lighting purposes is obtained through a transformer which steps down the current from 440 to 32 volts. An auxiliary lighting system, for use when the main generator is not running, comprises a small generator driven by a kerosene engine. With the exception of this small generator, which is of Western Electric manufacture, all electrical equipment on the dredge is of the Westinghouse type.

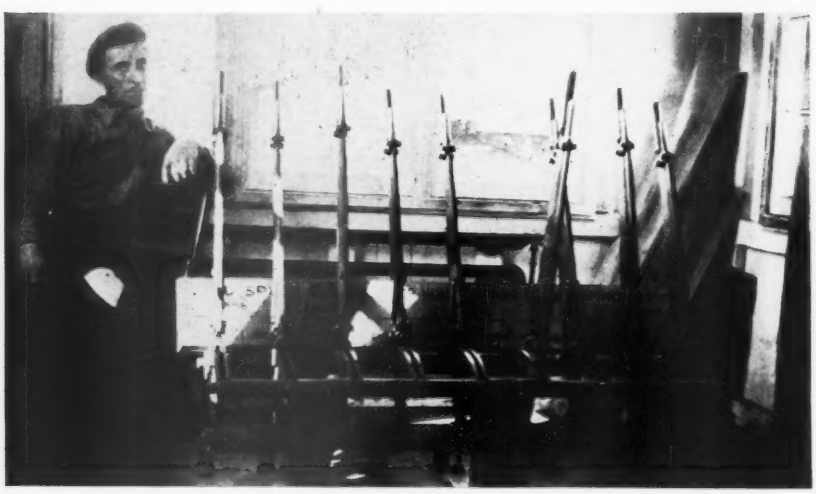
Fuel oil for the engine is pumped by a Viking geared pump, driven by a 2-hp. motor, from a 15,000-gal. tank mounted on a special barge which is kept in tow. From this tank the oil is pumped into a 7000-gal. tank located directly under the engine. The oil is fed from the smaller tank direct to the engine by its own pump.

The over-all dimensions of the dredge are 160x40 ft., with a 4½-ft. draft. The hull is divided into 13 water-tight compartments each of which is provided with a manhole for emergency pumping purposes. Steam for syphoning the dredge and barges is supplied by an upright boiler which uses the same kind of fuel oil as in the main engine.

The excavating equipment, of the ladder-type, is made up of an endless chain of 87 manganese lipped, steel cast buckets, of 8 cu. ft. capacity and weighing 1500 lb. each. This chain is mounted on a structural steel ladder 95 ft. long, the total weight of the ladder and chain of buckets being 125 tons.

The ladder is suspended concentrically with the upper tumbler and is inclined at an angle of 45 deg. for a maximum digging depth, which is 50 ft. below the water level. The upper tumbler is approximately 20 ft. above the deck and serves as a driving sprocket for the chain of buckets. Another tumbler is located at the extreme lower end of the ladder. The ladder is suspended by two 8-part steel tackle blocks from the overhead structural-steel gantry mounted near the bow.

Loading a barge with sand. The adjustable chutes permits loading anywhere in the barge



In addition to the nine levers shown in this illustration there are three more for controlling the movements of the ladder

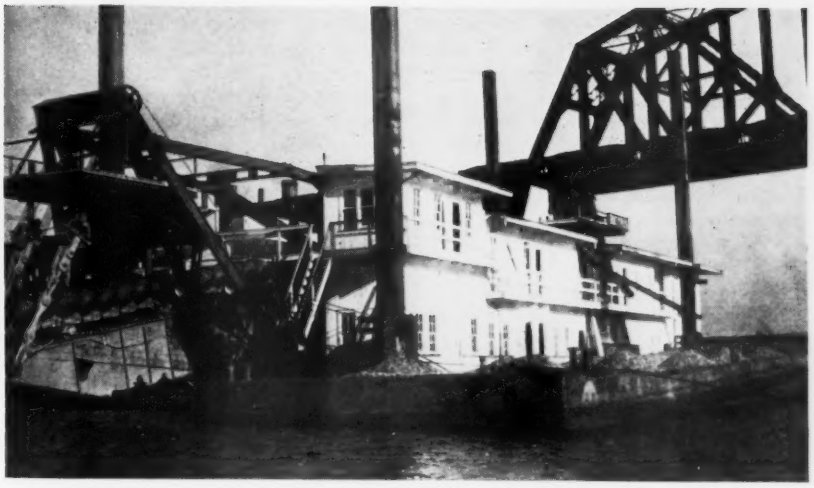
The sand and gravel is chuted by gravity from the hopper direct into a double-jacketed revolving screen 8 ft. in diameter by 30 ft. long. The screen, also of manganese steel construction, has three sections and is driven by a 50-hp. motor through a series of gear reductions and a friction roller drive. The first section is provided with ⅞-in. square perforations. Material passing through this section is then screened on the outer jacket of 3/16-in. perforations and from this screen the sand is chuted to a bin on one side of the boat. All material retained on the 3/16-in. screen is chuted to a bin on the opposite side of the boat. This material (3/16 x ¾-in.) is sold as pea-gravel. The second and third sections of the revolving screens have 1¾-in. and 2¾-in. perforations respectively.

The material is washed as it is dis-

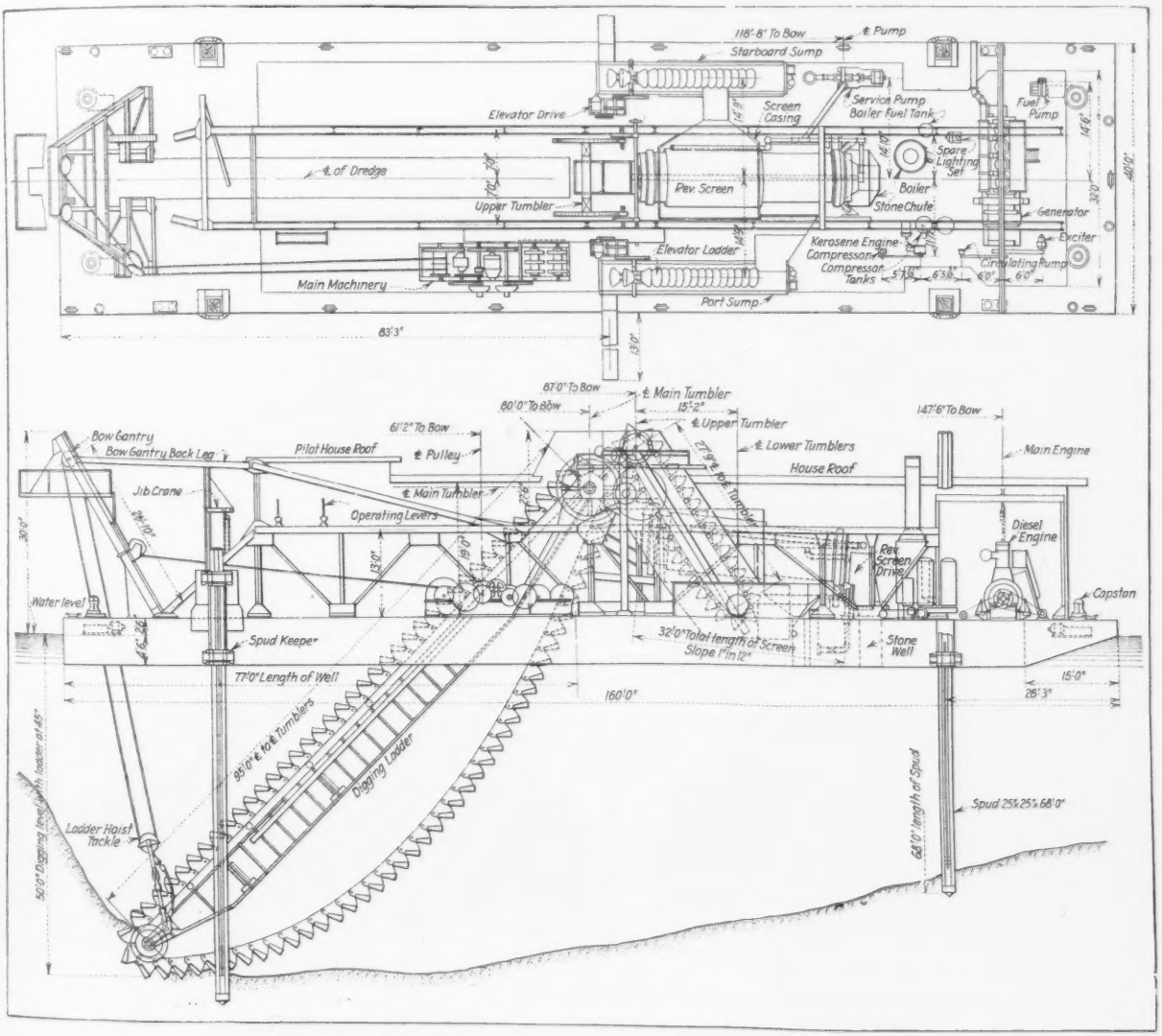
charged from the excavating buckets into the hopper. Water is supplied to the hopper by a 4-in. centrifugal pump driven by a 20-hp. motor delivering 450 g.p.m. through a 4-in. line. In addition to the washing it receives at the hopper, the material is washed as it is screened. An 8-in. stream is delivered to the screen by a Lawrence centrifugal pump with a 10-in. suction. This pump is driven by a 50-hp. motor and delivers 1800 g.p.m.

Sand and the different sizes of gravel are removed from the storage bins by chain bucket elevators. These elevators have 34 buckets, each bucket of 4 cu. ft. capacity. The elevators discharge into steel hoppers from which the material is removed by gravity chutes direct into barges on either side of the dredge. All elevators are controlled by variable-speed motors so that the speed may be adjusted in proportion to the amount of material being excavated.

The dredge is provided with four 24-in.



Gravel is loaded on this side of the dredge and sand on the other side. Note the height of the raised spuds



Sectional drawing showing details of the electric dredge "Elizabeth Pfeil"

square timber spuds, 68 ft. long, each made from one piece of Oregon fir. Corners of the spuds are fitted with ¾x8x8-in. steel angles. Each spud weighs approximately nine tons.

Four capstans are used for moving the barges and placing them in their proper places alongside the dredge. Each capstan is driven by a 20-hp. motor and is operated by controllers nearby.

Practically the entire operation of the dredge is controlled by one man in an elevated pilot house where there are 12 levers. From the pilot house the operator has a good view of the ladder and bucket line. The movements of the ladder and the bucket line are controlled directly by five levers connected to a five-drum winch on the port side of the dredge forward of the tumbler center line. This winch is direct-connected by gear to a 125-hp. motor. Complete control of the ladder and bucket line is effected at all times through brakes on the winch which holds the ladder in any position irrespective of the position or speed of the bucket line.

Every Convenience for Crew

No expense was spared in the provision of living quarters for the crew aboard the dredge. On the upper deck there are 14 individual rooms, each furnished with a bed, chair, clothes-closet and lockers, and supplied with steam heat, electric lights and running hot and cold water. In addition to the crew's sleeping quarters, there is a large dining-room and kitchen. The dining-room accommodates 20 men; the kitchen is outfitted with the most modern equipment (including an electrical refrigerating plant).

Captain Thomas Hudson is in charge of the dredge. H. M. Pfeil is president, H. G. Owens is treasurer, and Joseph Hoeveler is general manager of the company, with offices at 801 Bessemer building, Pittsburgh.

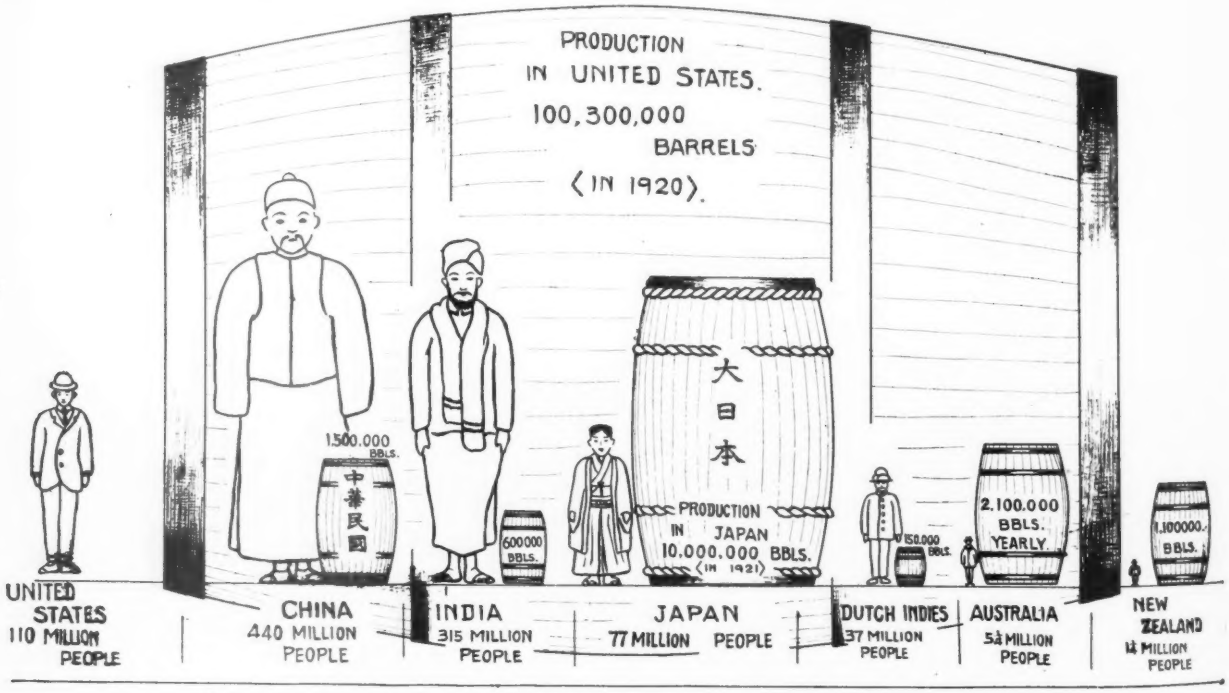
Cement a Great Factor in Asia's Progress

Part 1—Increasing Use of This Material Solving Many Important Problems of Long Standing

By Paul C. Van Zandt
Chief Engineer, Asano Portland Cement Co.

PORTLAND CEMENT is the newest, best and cheapest permanent building material known to men. It is shipped from the factory to the user as a finely ground, dry powder in sacks or barrels. When used it is mixed with an aggregate such as sand and gravel, water is added and the soft, soapy mixture is poured into molds or forms in which it hardens in a few hours and within a few days it has acquired the remarkable strength and durability of rock.

Its use therefore involves only the simplest processes possible. It is, in the writer's opinion, one of the most wonderful materials ever produced by man, ranking close to iron and steel in importance and of the very greatest value in the upbuild-



COMPARISON OF CEMENT PRODUCTION AND POPULATIONS OF VARIOUS COUNTRIES

ing of modern material civilization. Its manufacture and use in the Orient, where it comes into competition with the crudest materials of construction and cheapest labor and most limited buying power in the world, is interesting in the extreme.

At the present time, when the industry of the world has slowed down and factories and ships are idle in Japan, as they are elsewhere, the cement business almost alone is extremely active, with a great demand exceeding the production. This article attempts to explain the underlying causes of this phenomenon and to prophesy what this and similar industries in the Far East will do for the Orient and how they are even now changing the oldest civilizations of the world.

Before the very dawn of history primitive man mixed mud and water and used the semi-fluid mass for a building material which hardened in drying after it had been formed or placed. It is still used extensively, throughout the world today, and yet it is the poorest and most impermanent form of construction.

The First Improvement on Mud

The first improvement on this mud wall was represented by the sun-dried mud brick. Evidences of the use of such brick also date back to prehistoric man. The Israelites made this brick in ancient Egypt and the same brick is used today throughout the world, especially in dry countries. The "adobe" of Mexico is an excellent example. The outer city wall of Mukden, the capital of Manchuria, is made of it and it is fast crumbling into a ridge of earth covered with poor vegetation, valueless to keep out any foe or perpetuate the ancient importance of the birthplace of the Ching dynasty.

In still very ancient times brick made from clay was burned into hard vitrified blocks by fire and laid in lime mortar made by burning limestone. Portland cement is made by burning a mixture of this same kind of clay and limestone to incipient fusion at a white heat and pulverizing the resultant clinker. It is remarkable that this new and wonderful building material should be made from the most anciently used substances simply by combining them and burning a little harder than formerly, and that its use should follow the most ancient of processes.

It would appear that the brick and mortar of earlier times, being burned together from both brick and mortar in one mass, is as simple to use as the original mud used by our ancestors when they first built their houses in prehistoric ages.

The Romans knew the use of hydraulic cements before the Christian era and left works as far East as Aden, made of what is known as Puzzolan cement. This was made of a volcanic "tufa" found in Italy —in fact, under Rome itself—mixed with quicklime, and ground without burning or slaking. This is not true portland cement, however, as this substance was first made in England a little more than a hundred years ago. The remarkable excellence of portland cement over all other similar building materials and the comparative cheapness of its manufacture has resulted in the enormous present-day use, extending even to the ancient countries of the Orient.

The countries bordering the Pacific ocean present the greatest contrasts in civilization known to the world and the difference is reflected in the use of cement as well as nearly all other commodities that have grown from luxuries to necessities in European and American civilizaton in the past two hundred years.

The United States, with 110,000,000 people, uses over 100,000,000 bbl. of cement annually, or nearly one barrel of cement per inhabitant per year. This per capita consumption is found in Canada and New Zealand as well. Australia, with its sparsely inhabited territory, consumes about one-half barrel per inhabitant, as shown by the illustration. Such European countries as England, France and Germany use (or did before the war) about the same amount per capita, roughly speaking, as does Australia.

PER CAPITA CONSUMPTION OF CEMENT IN ORIENTAL COUNTRIES

Country	Population	Consumption Bbl.	Per Capita Bbl.	Lb.
China	440,000,000	1,850,000	.004	or 1.6
Jap. Empire	77,000,000	9,000,000	.117	or 44.4
Brit. India	315,000,000	1,600,000	.005	or 1.9
Dutch E. Ind's	37,000,000	650,000	.017	6.7

PER CAPITA CONSUMPTION OF CEMENT IN COUNTRIES OF GREATEST CONSUMPTION FOR COMPARISON

Country	Population	Consumption Bbl.	Per Capita Bbl.	Lb.
United States	110,000,000	103,000,000	.937	or 356
Canada	8,770,000	8,000,000	.92	or 347
New Zealand	1,260,000	1,100,000	.873	or 332
Australia	5,000,000	2,100,000	.42	or 160

These tables show the enormous possibility for the use of cement in the Orient.

If these Oriental countries were to use as much as United States, for example.

China would use 222 times as much as at present.
Japan would use 8 times as much as at present.
India would use 187 times as much as at present.
Java would use 53 times as much as at present.

Industrial Advance of Japan

With these figures for comparison, the remarkable industrial advance of Japan stands out clearly in comparison with the status of other Oriental nations. Japan proper uses about 1/5 bbl. per inhabitant, or 1/8 when her populous but slightly developed possessions are included, namely Korea and Formosa. In addition Japan exports 10 per cent of her production to other Oriental countries. The present Japanese production of more than 10,000,000 bbl. per year is more than that of all the rest of the Orient put together and even a little more than is produced by Canada. From the time when cement was first produced in the Far East this has always been true and the present rate of increase of Japanese production indicates an extended period of supremacy. The tables of prices and production illustrate clearly the advantage gained by Japan during the war when foreign imports were cut off. It is questionable whether foreign companies can ever regain any large part of this market in the face of the efficient production in this country.

The Asano Cement Co. is by many times the largest in the East and is the largest in the world outside the United States. The best plant now built in the Orient is, in the writer's opinion, the Kawasaki factory of that company. There are several others that are very modern and well built in China as well as in Japan, and the description of the Kawasaki factory which follows may serve as being typical of the best in this part of the world.. Several of the very small plants are crude, but their capacity is so small that they are not representative of the development of the industry.

The Kawasaki plant is really two factories built at different times and differently equipped, but interconnected and having a total capacity of about 1,500,000 bbl. yearly. The limestone comes from the Ome district, a few miles west of Tokyo and at the edge of the mountains. This rock is quarried by air drills, blasted, crushed and shipped to the plant on Tokyo bay over the government railways. The plant requires 1000 tons daily.

The clay comes from a hill at Ofuna, a junction on the railway near Yokohama. It is mined by driving parallel tunnels into the hillside a few feet apart and "robbing back" the walls between the tunnels until the undermined bank caves in and falls to the quarry floor in pieces small enough to load into railway cars for transportation to the plant. Of this, 400 tons are required daily at Kawasaki.

The coal comes from Hokkaido, Kyushu, and a small portion from Iwaki, all by ship and sampan to the side of the plant. About 240 tons are burned daily.

A small amount of gypsum ($CaSO_4$ plus $2H_2O$) is used in all cements to regulate the setting time. At Kawasaki 20 tons are used daily and it comes from Sendai by rail.

The cement is shipped out by railway and lighter. For export the lighters or sampans are towed alongside the steamers in Yokohama harbor, five miles away.

For many years, all cement for ocean export, wherever made, has been shipped in wooden barrels (an inconsequential amount by steel barrels), but in recent times the cloth bag has been so perfected that it is rapidly replacing the barrel which is so easily broken and so difficult to repair and handle. For special requirements at Kawasaki, the cement is exported in jute bags of 95 lb. each (four to one barrel) with a waterproof paper liner. This strong bag can be easily handled by the ship's tackle without fear of breakage or damage by water; it is easy to repair, if necessary, and extra empty bags are

always sent to be filled with the spill, if any occurs. So far as the writer is aware this method of shipping cement is unique in the Orient.

The Kawasaki factory is built of reinfoced concrete throughout, with Truscon steel reinforcement, unquestionably the best form of structure for factory buildings in the world. The equipment of the second half is entirely American make, while the first half is provided with German machinery, purchased before the war.

In making cement the raw materials are first crushed and, in the case of the clay and coal, thoroughly dried. Following this the clay and limestone are mixed in the exact proportion required for the chemical combination and ground together in heavy revolving barrels, 7 ft. in diameter by 24 ft. long, half filled with iron balls. This process is all continuous, the material entering and leaving the grinding machines through hollow trunnions upon which the mills revolve, and more than 3000 lb. of this mixture of hard rock and clay must be pulverized to the fineness of flour each day. This requires 1500 hp.

The mixed and ground raw materials are then placed into correction tanks which blend the mix and store the product until it is required by the kilns.

The kilns of a modern cement factory are always what is known as "rotary kilns." In Kawasaki there are four of these machines, 9 ft. in diameter and 180 ft. or 200 ft. long, two of each size. Each machine looks like a large smokestack on its side, rotated by gearing and carried on rollers and tires. The shell is very heavy, being made of ¾-in. steel plate, strongly banded and tired and lined throughout its length with firebrick on the inside. The rotating weight is about 300 tons.

The dry powdered raw material is fed into one end of this brick-lined shell, which is 8 ft. higher than the other, and the slow rotation of the shell once in about 2 min., causes the material to travel gradually to the lower end, the journey requiring about 8 hr.

Powdered coal is blown into the lower end of the kiln shell by a fan and is ignited, heating that portion to a white heat inside. The heat travels upward toward the entering material and leaves the kiln at its upper end from which it enters "waste-heat" boilers, which produce the steam which operates the plant by driving a steam turbine.

The raw material in its passage through the kiln is first gradually heated; then the limestone is burned to quicklime and when the powdered mix reaches nearly to the discharge end and enters the white hot portion of the kiln, the clay and quicklime combine, forming a sticky semi-fused mass which forms into balls like marbles and which, when cool, are nearly black. This "clinker" is a somewhat complicated chemical compound sometimes called a trycalcic sylicate of iron and alumina and is harder than glass. It is ground to the fineness of flour in grinding machines which are duplicates of those on the raw side, and 2 per cent of gypsum is added. This resulting powder is portland cement.

Cement making is a very simple process of "grind, burn and grind," but in the process of making 5000 bbl. a day the following amounts must be ground to the fineness of flour:

1,000 tons limestone
400 tons clay
240 tons coal
900 tons clinker

Total 2,540 tons every 24 hr.

The process is continuous for the hours except the quarrying, and is usualy worked in two 12-hr. shifts of workmen.

(To be continued)

New President of Taylor-Wharton Co.

AT a special meeting of the board of directors on January 26, Percival Chrystie was elected president of the Taylor-Wharton Iron & Steel Co., High Bridge, New Jersey, to succeed the late Knox Taylor. Mr. Chrystie was formerly vice-president and has been acting president since Mr. Taylor's death.

Mr. Chrystie was born in High Bridge. He attended the local school and also the Leal school of Plainfield. He started to work for the company as office boy during his school vacations. Going into the shops, he progressed until he became inspector. Then he went into the sales end and introduced the use of manganese steel in the Pennsylvania coal regions.

Returning to the plant, he worked up to be superintendent of the steel foundry, then secretary and treasurer, and finally vice-president, a position he held for many years. His selection as president comes as a well-deserved recognition of ability after over 30 years' service. He is also president of its subsidiaries, the William Wharton Jr. & Co., Inc., Easton, Pa.; Tioga Steel & Iron Co., Philadelphia, and Philadelphia Roll & Machine Co., Philadelphia.

Mr. Chrystie is a member of the New Jersey State Board of Conservation and Development, a director of the First National Bank of High Bridge, director of the Delaware & Bound Brook railroad, member of the American Steel and Iron Institute, American Institute of Mining and Metallurgical Engineers, the Engineers' Club and the Railroad Club of New York, and the Manufacturers' Club of Philadelphia.

First Aid for Producers

HERE is a schedule of meetings to be held to teach first aid to Wisconsin quarrymen, gravel pit men, contractors and others interested in safety. Classes will start at 1:15 on the opening day. The full course of training consists of 15 hours and it is important to report for training on the opening day. It will be noted that classes at Ablemans and Mayville are to be conducted simultaneously, and the same applies to Red Granite and Berlin.

There are probably many operators of quarries and gravel pits who cannot have their employes receive this training at one of the places listed on this itinerary, and in such cases arrangements can probably be made to give the training if a minimum group of 15 can be secured.

Milwaukee, City hall, February 14, 15, 16; Lannon, February 21, 22, 23; Ablemans, February 28-March 1, 2; Mayville, Steel & Tube Co. plant, February 28-March 1, 2; Fond du Lac, City hall, March 6, 7, 8; Red Granite, Town hall, March 13, 14, 15; Berlin, City hall, March 13, 14, 15; Green Bay, American Legion hall, March 20, 21, 22; Wausau, City hall, March 27, 28, 29.

Should any other information be desired, the Industrial Commission will furnish it on request.

Hely Stone Co. to Double Plant Capacity

THE Edward Hely Stone Co., Cape Girardeau, Mo., plans to double its plant capacity this year. The new machinery includes a 1½-yd. steam shovel, and two 2-ton Packard dump trucks for transporting the rock from the quarry to the plant. These improvements have cost approximately $25,000. Another feature is a 100-ft. well drill.

For the first time in its history the plant has been in full operation during the winter months. During the summer it will be operated on a 24-hour basis.

Ste. Genevieve Lime Kiln Destroyed by Fire

A LOSS of between $60,000 and $70,000, partially covered by insurance, is the result of a fire at the Ste. Genevieve Lime and Quarry Co. plant, west of Ste. Genevieve, Mo. The fire started at kiln No. 4, at which an oil burner had recently been installed. When the firemen were drawing the kilns there was an explosion, and within a short time the fire was beyond control. The buildings destroyed were the main shed, boiler shed, blacksmith shop, cooper shop, and the hydrating plant. The company plans to rebuild immediately.

Oklahoma Cement Co. Given Damage Claim

THE Oklahoma Portland Cement Co., Oklahoma, was awarded a $45,353.36 claim for excess freight charges against the St. Louis-San Francisco railroad by an order of the Corporation Commission. The company claimed that it had been charged excess rates from March 1 to November 30, 1920.

A Five-Billion-Dollar Building Year

The Survey Is Based on Confidential Reports from 1767 Architects Covering Projects in Process of Planning

THIS year will show a greater volume of building activity that the year 1922, declares the *Architectural Forum*, basing its statement on confidential reports received from architects throughout the United States.

"While it is true that the cost of building has advanced considerably within the past few months," says the *Forum*, "it is anticipated that this is but a wave in the general downward course of building costs. With renewed production activity and with relief from the rail and coal situation the cost of building should be on a downward trend again in the spring of 1923.

"It is highly important that all construction interests realize that the building market for 1923 is a market which must not be discouraged by high prices. It is a market which spells opportunity to make profits on volume of business rather than large profits on small business. The action of manufacturers, labor, finance and other factors which control building costs during 1923 will have much to do with the permanent prosperity of our industry.

"If a shortsighted policy is adopted involving the forcing of high costs because of demand, prospective owners of buildings of every type will find practical reasons for putting off construction and the element of financing will become discouraged even as it was encouraged during the period of declining costs late in 1921 and early in 1922.

"The first great waves of speculative building and construction of the cheaper type have passed and 1923 will be remembered as a year in which a great volume of good building construction was produced. It is evident that residential construction will continue in volume almost equal to that of 1922 with greater activity in the more expensive types of dwellings and probably in the hotel field.

"Industrial construction shows up with surprising strength, and the fact that this work is reported by architects indicates that a large proportion of the volume of industrial construction will be of a permanent, well designed character. Much of this construction represents plant expansion by well established manufacturing concerns, together with the establishment of new industries of substantial character.

"All evidence points to the fact that there will be available an ample amount of financing for this great volume of projected building construction.

"The problem of labor conditions is one on which no forecast can be made, but it is quite probable that 1923 will show a fairly good spirit of co-operation between employers and labor in the building industries. Labor leaders are becoming more farsighted and in certain of the trades there is a growing interest in the apprentice problem and the idea of admitting a larger proportion of new men into the ranks.

"Certain reactions are felt as the enforced shortage of mechanics in some of the trades brings about an elimination of the amount of work by mechanical methods or by substitution of materials not within jurisdiction of the particular trade in question.

"Considering all facts it is certain that 1923 should be a year of sound prosperity for all branches of the construction industry provided no advantage is taken of conditions either in the cheapening of the quality of materials or the enforcement of prices which represent too great a margin of profit."

FORECAST OF NEW BUILDING CONSTRUCTION FOR 1923

Based upon actual figures obtained in the most comprehensive survey of projected building construction ever attempted in the construction industry

BUILDING TYPES	N. EASTERN STATES	N. ATLANTIC STATES	S. EASTERN STATES	S. WESTERN STATES	MIDDLE STATES	WESTERN STATES	U S. A.
Dwellings (Under 20,000)	$16,622,000	$86,465,000	$12,825,000	$12,084,000	$59,160,000	$34,925,000	$222,081,000
" ($20,000 to $50,000)	11,668,000	41,828,000	8,587,000	10,552,000	33,468,000	12,757,000	118,860,000
" (Over 50,000)	6,045,000	27,481,000	2,031,000	6,113,000	21,077,000	10,444,000	73,191,000
Apartments	56,020,000	237,296,000	25,392,000	34,323,000	229,552,000	80,302,000	662,885,000
Hotels	33,589,000	141,146,000	27,683,000	40,765,000	205,332,000	60,475,000	508,989,000
Clubs, Fraternal, etc.	15,888,000	58,221,000	13,268,000	28,784,000	109,700,000	50,406,000	276,266,000
Churches	17,577,000	128,120,000	15,128,000	25,519,000	82,903,000	43,688,000	312,936,000
Community, Memorial	14,620,000	27,401,000	1,950,000	6,209,000	46,509,000	21,099,000	117,788,000
Welfare, Y.M.C.A., etc.	3,295,000	15,702,000	2,576,000	3,302,000	15,680,000	9,688,000	50,242,000
Hospitals	13,594,000	54,166,000	6,972,000	27,438,000	105,096,000	52,148,000	259,414,000
Office Bldgs.	21,157,000	88,877,000	18,089,000	26,359,000	190,486,000	82,603,000	427,570,000
Banks	17,608,000	54,328,000	8,835,000	18,783,000	154,482,000	38,669,000	292,705,000
Schools, Public Bldgs.	65,159,000	158,165,000	41,515,000	31,930,000	383,036,000	190,228,000	870,034,000
Theatres	9,573,000	34,847,000	2,759,000	7,381,000	29,388,000	17,943,000	101,891,000
Stores	11,113,000	35,383,000	6,826,000	7,480,000	58,361,000	27,723,000	146,887,000
Industrial	29,859,000	162,762,000	38,824,000	25,231,000	241,871,000	49,488,000	548,037,000
Automotive	11,988,000	35,942,000	2,799,000	8,386,000	52,464,000	15,190,000	126,768,000
Total Value of New Buildings	$355,375,000	$1,388,130,000	$236,059,000	$320,639,000	$2,018,565,000	$797,776,000	$5,116,544,000

Total value of new building in forecast for 1923 is $5,116,544,000

The Design of Sand Plants

By Edmund Shaw
Consulting Engineer, Chicago

No. 5—The Use of Hydraulic Water to Remove the Last of the Dirt, and Also to Separate Sand Into Sized Products. How to Design the Plant for It So As to Avoid Failure

THE separation of the unwanted fine sand from the product of the sand plant has already been discussed in the earlier numbers of this series, and it was shown how, by proper design of the settling box, the water in the feed stream could be made to effect the separation.

The separations made in this way are rather crude, for the reasons given in the discussion of settling boxes. When we wish to better the work, we must use another current than that of the feed stream to refine the work of the feed stream. This extra current is produced by what is known as hydraulic water, and the device in which it is used is known as a hydraulic classifier.

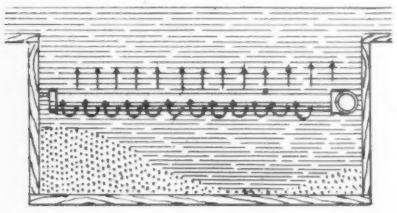


Fig. 25—The simplest device for using hydraulic water, but one that has been successfully used for making filter sand

Nearly two years ago, the writer wrote a series in ROCK PRODUCTS called, "Sand Settling and Sand-Settling Devices." In this series the whole subject of hydraulic classification was treated at some length, and a number of forms of hydraulic classifiers were described and illustrated. For this reason, the subject will be treated briefly here.

About the simplest form of hydraulic water device which the writer has seen in use in sand plants is a simple settling box with a row of pipes. These pipes were connected to a single-header pipe which supplied them with water, and there were a lot of small holes in the pipes through which the water escaped into the settling box. The pressure in these pipes was kept to where it produced a slow rising current in the box. The arrangement is shown in Fig. 25.

Such a box has been used in a plant in Pennsylvania and in another plant in Washington, D. C., for making filter sand. It is a crude device as compared with a well-designed hydraulic classifier, and requires constant attention, but it has worked and it made a product in both cases which met the rigid specifications of filter sand.

Such a box must work intermittently. It is fed with sand until it fills up, so that it will not work well any longer and then emptied. This is why constant attention is required. But it is possible to make devices of the kind which are quite automatic and require practically no attention whatever.

In the description of the plants of the Stewart Sand Company, in the issue of January 14, a description is given of the use of hydraulic water in an automatic device which has proven very successful in practice. This is a patented device attached to one of the automatic discharge sand settlers which were discussed in No. 4 of this series. The water is admitted through pipes in the sand bed of the settler and the slow, rising current works its way up through the sand, lifting the mud and fine sand that is not wanted and carrying them to the waste overflow.

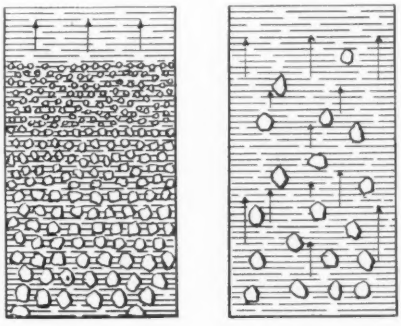


Fig. 26—In hindered settling the grains dance in the slow-rising current and arrange themselves in layers, with the largest at the bottom. In free settling they easily fall through the current

This is the best way of which the writer knows to give a second wash, or rinse, to sand which still contains clay after the first wash. The amount of water required is reduced to the minimum—just sufficient water to fill the voids in the sand and displace the muddy water which they contain, with a slight excess to produce the slow rising current. None of the water is lost by flowing over the top of the sand without coming in contact with it. All of the water does some work, just as it does in washing gravel on a screen, which we all know to be the most effective way of using water. In fact, this use of a rising current in sand is the same thing as the washing of gravel on a screen, the only difference being that the current flows up instead of down.

The Two Ways of Using Hydraulic Water Are with Hindered and Free Settling

This method of applying hydraulic water is what is known as hindered settling. If it is carried far enough, the grains will arrange themselves in layers, with the coarsest at the bottom as shown in Fig. 26. If a grain is pushed out of the layer to which it belongs, it will return to its proper place, as may be shown by forming such a hindered settling column in a glass tube. By drawing off portions of such a column we may obtain a series of sized products.

The hindered settling classifier does this work of forming a column and withdrawing the sizes needed continuously. This machine has not been used much in ordinary sand washing, but it has been successfully used in the preparation of sand-blasting sands, which have to be carefully sized. An illustration of one form of hindered settling classifier making blast sands is given in Fig. 27.

There is another way of using hydraulic water which is called free settling. The water is put in at the apex of a cone or pyramid. It splits and flows up into the cone and out of the discharge opening at the bottom. The part that flows up creates the rising current.

This is an old method once much used for classifying crushed ore into sized products, but not so much used now since the improvements in fine screens. It takes a lot of water and it must be given a steady, uniform feed to do good work. The latter

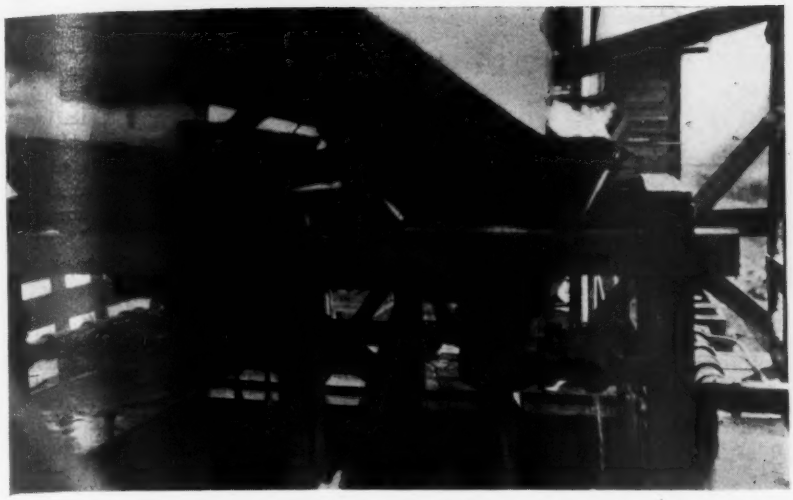


Fig. 27—A battery of hydraulic classifiers making blast sands

condition is one that is sometimes hard to meet in a sand plant.

Nevertheless, free-settling hydraulic classifiers, of the type called *spitzkasten,* have found some use in sand-washing plants in Colorado and other Western states, where they were familiar from their use in ore-dressing plants. A typical *spitzkasten* is shown in Fig. 28, which illustrates a double form designed to make two products.

Designing Plants to Use Hydraulic Water

Plants which are to use hydraulic water, either for giving a second wash to remove clay or to separate sand into sized products, must be designed with that end in view. It must always be remembered that such devices demand three things to do really good work: A constant and uniform flow of feed water; a fairly uniform feed of solids, and a constant and steady pressure for the hydraulic water. If these three are provided, the plant will do very good work indeed, and it will run practically without attention. But if one of these is omitted the work will be indifferent or poor and the plant will need considerable attention to do even average work.

Ordinary variations in the feed of solids may be compensated for, and are compensated for in one form of patented machine. But there is no way of compensating for variations in the amount of feed water used or for variations in the pressure of feed water without putting in special arrangements in the design of the plant.

The only device of which the writer knows for giving a uniform flow to the feed water is the "surge tank" or stay box, which was described in the first number of this series, published January 16, 1923. During the periods when the feed water is in excess, the excess is thrown over the overflow lip of the surge tank, thus keeping a fairly constant quantity going to the classifier or sand settler. There will be some difficulty in regulating the feed water if there are many stoppages of the feed, but this may be provided for in part by having the surge tank large enough to serve as a reservoir, storing up sufficient water to carry the feed for a few seconds' stoppage. This method has been applied to a plant fed by a pump, the tank being large enough to carry the feed during a one-minute shutdown.

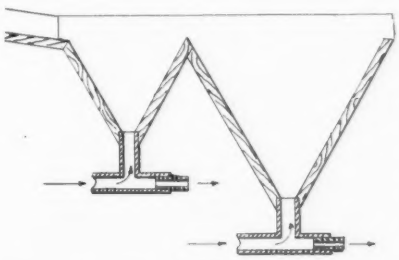


Fig. 28—The Spitzkasten is an old device for using hydraulic water. This is a double form for making two sizes of sand

Variations in the feed of solids may be compensated for by the design of the sand settler, but where these variations are large such compensation will not be sufficient, especially if fine work is wanted, as in making filter and blast sands. For this work it is better to separate the classification from the washing of the sand altogether. The plant will then be designed to take a part, or all, of the regular washed sand product that has been washed and dewatered and separate it into the sized products wanted, either by classifiers or screens. This is, in fact, the method adopted in those plants which specialize in making blast sand and filter sand.

In such plants the sand is fed (damp) from a bin by some form of mechanical feeder. There are a number of these on the market, piston feeders, screw feeders, etc., and the choice is largely a matter of one's experience with a certain type.

How Steady Pressure May Be Given to the Water

There are two ways by which a steady and uniform pressure may be given to the hydraulic water. The first of these is a supply tank fitted with an overflow. The pump is set so as to throw the maximum amount of water that is needed, and when any less quantity is needed it will go out of the overflow without perceptibly raising the level of the water in the supply tank. This is the better method, as the pressure is very uniform, the variation due to the rise of the water on the overflow lip being so slight that it can hardly be measured.

The other method is to fill the tank from a pipe which has a valve controlled by a float, like the ordinary ball cock used in plumbing. As there has to be a considerable rise and fall of the water to open and close the valve by the float, this does not give so steady a pressure as the tank with an overflow. But it has the advantage of saving water, and it may be used where the tank is supplied by a pump

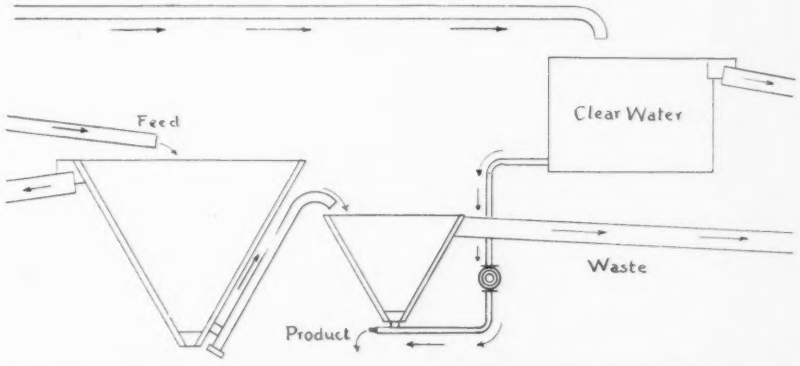


Fig. 29—Every plant using hydraulic water must have the units of design shown in this diagram to do good work

which has to supply other parts of the plant.

The tank which has been spoken of is a necessity, and experience has shown that it is hard to do good work with hydraulic water supplied directly from a pump.

The diagram, Fig. 29, shows the essential features of the design of a plant in which hydraulic water is to be used. The feed of water and sand enters through the trough shown at the left and falls into the surge tank, which has an overflow to carry off excess water and give a steady feed to the classifier, which in this case is a simple *spitzkasten* of the type shown in section in Fig. 27. This makes a rough classification by the feed water, which is refined and completed by the rising current of hydraulic water.

This hydraulic water comes from the supply tank above, the tank being provided with an overflow for the purpose of maintaining a uniform pressure, in the way that has been explained. There is a valve in the pipe from the supply tank to the classifier by which the amount of hydraulic water furnished is regulated, and the valve gives the only adjustment that is needed, except that at the start the size of the discharge pipe at the bottom of the *spitzkasten* must be found by experiment.

This may seem a good deal of explanation for a simple matter, but it seems necessary in the light of what the writer has seen in visiting plants in which classifiers of this kind are installed. It is often considered too much trouble to make the proper arrangements for the use of hydraulic water.[1]

A common fault is that of taking the supply from a pipe that furnishes water to two or three other things in the plant, so that half the time or more the hydraulic water will be insufficient in amount. There is an objection to the use of the surge tank because it takes up a little head room. So these things are omitted as needless refinements, with the result that the work of the plant is very poor at times and the whole system is condemned.

The proper use of hydraulic water gives us the cheapest and simplest method of rinsing, or giving a second wash, to remove the last of the clay. It also furnishes the surest method of classifying fine sand into a series of sized products. But it must be applied with intelligence, and the plant which is to use it must be designed with that end in view.

(To be continued)

Cement Fire Tests

THE correct composition of cement blocks to give the highest fire resistance qualities is being studied at the fire underwriters' laboratories at Chicago, at the request of cement manufacturers. Tests which have been under way for some time cover many different mixtures of cement, sand, gravel, and other materials. Walls composed of several kinds of blocks have been built up in front of gas furnaces and subjected to 5 hr. of intense heat, reaching 2075 deg. at the end of the period.

Through electrical heat recorders, cemented with the blocks themselves, and thermometers and measuring devices on the outside, the engineers have traced the effect of heat changes on the various materials. The walls usually buckle somewhat under the heat, the center curving in toward the fire, due to the expansion of the inner side.

In some of the tests after 5 hr. of baking, the red hot wall has been subject to 5 min. of cooling under a 2-in. fire hose. The sudden cooling splits the fine gravel in the outer surface of the block, and fine particles fly through the air, leaving the surface pitted as though under a sand blast. Despite this treatment the walls have still stood. The blocks withstand heat so intense that the surface of the bricks surrounding the test walls turned liquid and flowed down its frame-work.

Mining Diatomaceous Earth

By E. D. Gardner
Mining Engineer, U. S. Bureau of Mines

A LARGE deposit of diatomaceous earth or kieselguhr is mined near Lompoc, Calif. It covers several square miles and ranges up to 700 ft. thick. The bed contains many folds, but was apparently laid down horizontally at the bottom of a fresh-water Miocene sea. Kieselguhr consists of the siliceous skeletons of diatoms, of which over 2000 varieties have been identified.

The deposit is owned and worked by the Celite Products Co. H. S. Thacher of Los Angeles is general manager and E. B. Starr of Lompoc is plant manager. The company has a mill for treating a part of the product at Lompoc, which is about four miles from the quarries. At the present rate of production, the supply should last for centuries.

The principal uses of the kieselguhr are: (1), sawed brick for refractory purposes; (2), compressed refractory brick, which in quality is between the sawed brick and ordinary firebrick; (3), ground product, used as filtering material at sugar mills; (4), lightweight filler in concrete, used instead of rock aggregate in some government work; (5), insulation purposes; (6), automobile polish, silver polish, diluting talcum powder, etc.; (7), nitroglycerin absorbent in some grades of dynamite.

The character of the material varies in different parts of the bed and only selected parts are quarried where the overburden is light. Also, certain parts of the bed are used for specific purposes. After cleaning off the overburden the diatomaceous earth is quarried by means of a channeling machine developed by the company. Cuts are made across the face 4 ft. deep and 4 ft. apart. The largest part of the production is used for insulating brick, which are sawed on the ground from the blocks cut by the channeling machines. The machine used for sawing the brick was also developed by the company. The material desired for grinding is quarried, after channeling, by pick and shovel and loaded by hand into horse-drawn wagons and then hauled to a drying yard. The brick are hauled to a drying yard in light tram cars. After sun-drying, the brick are hauled to the railroad, and the other product to the mill in motor trucks.

At the mill the sun-dried diatomaceous earth is fed by hand into an impact pulverizer, which is moved along the bottom of the storage bin. The pulverized material is drawn through galvanized iron tubing by an exhaust fan to the main building, where it is packed for shipment in bags. The unbroken single diatoms are desired for filtering and some other uses. The dust, consisting of the finer particles and broken diatoms, which does not settle in the bins of the main building, is drawn into a bag house where it is filtered out of the air. This material is used for polishes and other similar purposes. All crushing is done dry.

The kieselguhr is nearly pure silica and has the capacity of absorbing several times its weight of liquids. Dr. Herbert Insley, petrologist, U. S. Bureau of Mines, examined some of the samples under the microscope and made the following report:

"This material is very light in weight, due in part to its great porosity. Under the microscope the material was found to be made up almost wholly of the tests or skeletons of diatoms. These tests are composed of practically pure silica. The silica is evidently amorphous, for there is no evidence of double refraction between crossed nicols. Most of the skeletons were unbroken. Complete skeletons more than three-tenths of a millimeter in greatest dimension were not observed, although some of the skeletons of which fragments were observed must have been at least seven-tenths of a millimeter in length. Disk-like diatoms containing hexagonal perforations or depressions and long, slender spine-like diatoms are very common."

Photomicrographs made by Dr. Insley show considerable fine dust and many sharp-edged particles.

The deposit is damp when first exposed, but during the summer months the air is very dry and the wind blows almost continuously, hence the surface is soon dried. Since the kieselguhr is very light, the dust is easily picked up by the wind.—*U. S. Bureau of Mines, Reports of Investigations.*

Comparison of State Specifications for Crushed Stone and Gravel

A Review of Present Practice With Special Reference to Federal Aid Work

By F. H. Jackson

DURING the five years of Federal Aid for roads the U. S. Department of Agriculture, which administers the Federal Highways act, has through the Bureau of Public Roads approved hundreds of specifications which have been proposed from time to time by the various states.

In the early days of Federal Aid most of the states, especially those in which the highway departments had been newly organized, submitted specifications covering individual projects only—that is, a separate specification for each project. Later, however, as the materials and methods of construction became more nearly standardized it became the practice of many of the states to submit for approval as standard for all Federal Aid construction a single complete specification covering the various types of roads built in that state. At the present time 40 states have such standard specifications on file in the Bureau of Public Roads.

Formulation and Approval of Materials

It may be of interest to review and compare in a general way the requirements for crushed stone and gravel which the various states have established in their standard specifications. Before comparing these requirements, however, the function of the Bureau of Public Roads as regards the formulation and approval of materials must be thoroughly understood. The bureau does not fix standards covering the quality of any road material in any state. It does, however, review all specifications prepared by the states which have to do with Federal Aid work. As regards the material details of these specifications, approval is given when in the judgment of the bureau material of satisfactory quality will be insured, taking into consideration such variable factors as climatic conditions, probable extent and character of traffic, character and availability of sources of material supply, etc.

It can readily be seen that no single set of requirements could possibly be fixed for any given material which would be applicable for use throughout the United States, a fact which accounts in a large measure for many apparent inconsistencies in the various state standard specifications.

In order that the materials used in road construction may be of satisfactory quality it is the practice to subject representative samples to certain tests designed to measure the degree with which these materials possess the necessary physical properties. There have been three major tests developed for measuring the quality of macadam rock: the Deval abrasion test, the Page impact test, and the Dorry hardness test. The Deval abrasion test is the only one of these, however, which is in general use in all of the states at the present time. The hardness and toughness tests, and to a certain extent the test for crushing strength, are used in some of the states for the purpose of further controlling the quality of certain materials. For ordinary purposes and under general conditions it would seem that the Deval abrasion test alone is sufficient to secure satisfactory material for waterbound and bituminous macadam road construction. In selecting stone for bituminous concrete, however, many engineers require a toughness test, believing that toughness is an essential quality for this type of construction.

The Deval abrasion test is likewise extensively used for measuring the quality of crushed stone for concrete pavements. Although objection has been raised to the use of the test in this connection on the ground that it was developed for use in testing macadam rock, it appears to be the only one which is capable of measuring within reasonable limits the relative resistance to wear of materials of this nature. For this reason it will probably be used until a more suitable test is developed or until it can be shown beyond a doubt that the quality of the aggregate is of significance when the material is to be used in concrete pavements.

The Three Rock Tests Used

A very brief description of each of the three rock tests referred to in the tables may be of interest.* The Deval abrasion test may be considered a test for both impact and abrasion. Eleven pounds of broken stone consisting of 50 pieces of uniform size and shape are placed within a closed cast-iron cylinder which is mounted upon an axis inclined 30 deg. with its axis of rotation. The cylinder is given 10,000 revolutions at the rate of 30 per min. and the amount of dust worn off the stone which will pass a sieve having 16 meshes per linear inch is determined. The percentage rates of which the weight of dust bears to the original weight of the sample is called the percentage of wear. A figure called the French coefficient of wear with which all quarrymen are familiar is derived from the percentage of wear by dividing it into the constant 40.

The Dorry hardness test may be considered a test for abrasion only. A core 1 in. in diameter is drilled from the rock by means of a diamond drill and is held against a revolving cast-iron plate upon which quartz sand is fed to act as an abrasive agent. The hardness of the stone is measured by the amount of material worn off in 1,000 revolutions of the disk. The coefficient of hardness used in specifications is obtained by subtracting one-third the loss in weight in 1,000 revolutions from the constant 20.

The Page impact test is used to measure the toughness of the stone. A cylindrical rock core 1 in. in diameter and 1 in. in height is subjected to the blow of a hammer weighing about 4½ lbs. The first blow is given from a very small height, after which the height of fall is increased a definite amount after each blow until the test specimen is broken. The height of blow at failure expressed in centimeters is called the toughness. The test is made both parallel to and perpendicular to the plane of foliation, if any exists in the stone, and the results averaged. The present specifications for this test require that the result reported be an average of at least three individual determinations in each direction.

There is no standard method of making a crushing strength test of stone. The usual practice, however, is to test cylindrical specimens either 1 or 2 in. in diam-

*For a complete description of these tests, see U. S. Department of Agriculture Bulletin 949.

eter with a height either equal to or 1½ times the diameter.

The accompanying tables show the laboratory test requirements of the various states for the quality of crushed stone and gravel. In Table 1 minimum test limits are given for French coefficient of wear, hardness, and toughness of crushed stone to be used in broken stone and cement concrete foundations and in waterbound, bituminous macadam, bituminous concrete and cement concrete wearing courses, together with references to other tests which are sometimes required.

It will be observed that French coefficients of wear and not percentages of wear are tabulated. This is done for purposes of uniformity, although some of the states now express this requirement in terms of per cent wear rather than as coefficient of wear. In these cases the requirements have been converted into coefficients and tabulated to the nearest whole number.

Points in Connection With Requirements

It may be of interest to call attention to a number of points in connection with these requirements. In the first place, it will be observed that the quality of stone demanded for any one type of road depends very largely upon the quality of available material. For example, the state of Pennsylvania requires a French coefficient of wear of at least 10 on all stone for use in concrete pavement with the exception of limestone, which is limited to a coefficient of 8. This appears to be a perfectly reasonable requirement, because stone of the quality demanded can be readily obtained in this state.

On the other hand, Illinois specifies for this type of construction a French coefficient of wear of not less than 6, because experience has demonstrated that, for the type of limestone occurring in this state, material with a coefficient as low as 6 will give satisfactory service as coarse aggregate in concrete pavement. This is as low as any state has as yet gone in specifying stone for concrete road construction. Only one other state, Kansas, has as low a requirement as Illinois.

Another point of interest is the fact that certain states recognize that different types of stone for equal suitability for a given construction may have entirely different physical properties. For instance, every one knows that trap rock and granite of average good quality will show a much higher resistance to abrasion than the average limestone of good quality. It might, however, be very possible to obtain and furnish either granite or trap rock of comparatively inferior quality, due to weathering or disintegration, which would meet a test requirement reasonable for limestone. The alternate requirements set by Michigan, New Hampshire, New Jersey, and Ohio will illustrate the extent to which the type of stone may influence the test limits to be set for any given type of construction.

TABLE I.—MINIMUM REQUIREMENTS FOR QUALITY OF CRUSHED STONE FOR VARIOUS TYPES OF CONSTRUCTION BY STATES

State	Year Approved	FOUNDATIONS: Broken Stone Fr. Coef.	Broken Stone Hard.	Broken Stone Tough.	Cement Concrete Fr. Coef.	Cement Concrete Hard.	Cement Concrete Tough.	WEARING COURSES: Waterbound Macadam Fr. Coef.	Waterbound Macadam Hard.	Waterbound Macadam Tough.	Bituminous Macadam Fr. Coef.	Bituminous Macadam Hard.	Bituminous Macadam Tough.	Bituminous Concrete Fine Graded Fr. Coef.	Bituminous Concrete Fine Graded Hard.	Bituminous Concrete Fine Graded Tough.	Bituminous Concrete Coarse Graded Fr. Coef.	Bituminous Concrete Coarse Graded Hard.	Bituminous Concrete Coarse Graded Tough.	Cement Concrete Fr. Coef.	Cement Concrete Hard.	Cement Concrete Tough.
Alabama	1920	5	-	-	-	-	-	5	-	5	7	-	-	8	-	8	8	-	8	8	-	8
Arkansas	1918	6	-	-	10	-	-	10	-	-	10	-	-	8(1)	-	10	8(1)	-	10	10	-	-
Arizona	1920	-	-	-	-	-	-	-	-	-	-	-	-	8	-	8	8	-	8	8	-	8
Connecticut	1919	-	-	-	-	-	-	7	-	-	7	-	-	7(2)	-	-	-	-	-	7(2)	-	-
Delaware	1922	10	-	-	12	-	-	10	-	-	10	-	-	8	-	-	-	-	-	12	-	-
Georgia	1920	4	-	-	8	-	-	-	-	-	8	-	-	10	10	8	8	10	8	10	10	8
Idaho	1922	7	-	-	6	-	-	-	-	-	7	-	-	-	-	-	8	-	-	8(3)	-	-
Illinois	1920	5	-	-	6	-	-	6	-	-	6	-	-	-	-	-	6	-	-	6	-	-
Indiana	1922	5	-	-	-	-	-	7	12	5	7	12	5	-	-	-	-	-	-	-	-	-
Iowa	1920	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-(4)	-	-
Kansas	1922	5	-	-	-	-	-	6	-	-	6	-	-	8	-	-	-	-	-	6	-	5
Kentucky(5)	1922	5	-	-	7	-	9	6	-	9	6	-	9	6	-	9	6	-	9	7	-	9
Louisiana	1918	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maine	1922	7	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-	-	7	-	-
Maryland	1922	10	-	-	8	-	-	10	-	-	10	-	-	-	-	-	-	-	-	10(15)	-	-
Michigan	1922	7	-	-	7	-	-	7(5)	14	7	7(5)	14	7	7(1)	-	7	-	-	-	7	-	-
		-	-	-	-	-	-	10(7)	16	10	10(7)	16	10	-	-	-	-	-	-	-	-	-
Minnesota	1921	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	8
Mississippi	1922	-	-	-	-	-	-	-	-	-	-	-	-	10	10	8	-	-	-	-	-	-
Missouri	1919	8	-	-	8	-	-	8	-	-	8	-	-	-	-	-	8	-	-	-(8)	-	-
Nebraska	1922	-	-	-	7	-	-	-	-	-	-	-	-	10	-	8	8	-	8	10	-	10
Nevada	1920	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
New Hampshire	1918	-	-	-	8	-	-	13(2)	-	-	13(2)	-	-	-	-	-	-	-	-	8	-	-
		-	-	-	-	-	-	9(9)	-	-	9(9)	-	-	-	-	-	-	-	-	-	-	-
New Jersey	1922	-	-	-	13(2)	-	-	-	-	-	-	-	-	13(2)	-	-	13(2)	-	-	13(2)	-	-
		-	-	-	11(10)	-	-	-	-	-	-	-	-	11(10)	-	-	11(10)	-	-	11(10)	-	-
		-	-	-	9(11)	-	-	-	-	-	-	-	-	9(11)	-	-	9(11)	-	-	9(11)	-	-
		-	-	-	7(5)	-	-	-	-	-	-	-	-	7(5)	-	-	7(6)	-	-	7(5)	-	-
North Carolina	1922	8	-	-	8	-	-	10	-	-	8	-	-	-	-	-	8	-	-	10	-	-
North Dakota	1922	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-
Ohio	1922	3(5)	-	4	5(5)	12	5	5(5)	12	5	7(5)	15	6	7(5)	15	6	7(5)	15	6	7(5)	15	6
		8(7)	17	8	8(7)	17	8	8(7)	17	8	8(7)	17	8	8(7)	17	8	8(7)	17	8	8(7)	17	8
Oklahoma	1922	8	-	-	7	-	-	-	-	-	8	-	-	7	-	-	-	-	-	7(14)	-	-
Oregon	1922	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	10	-	-	10	-	-
Pennsylvania(12)	1922	10	-	-	8	-	-	10	-	-	10	-	-	10	-	-	10	-	-	10	-	-
		-	-	-	-	-	-	-	-	-	-	-	-	8(5)	-	-	8(5)	-	-	8(5)	-	-
South Carolina	1921	5	-	-	-	-	-	7	-	-	7	-	-	-	-	-	8	-	8	8	-	8
South Dakota	1920	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	8	8	-	-
Tennessee	1922	7	-	-	-	-	-	7	-	-	7	-	-	8	-	-	8	-	8	8	-	-
Texas	1920	8(13)	-	-	-	-	-	8(13)	-	-	8	-	-	-	-	-	-	-	-	8(13)	-	-
Utah	1919	10	-	-	8	-	-	10	-	-	-	-	-	8	-	-	8	-	8	8	-	8
Vermont	1919	7	-	-	-	-	-	7	-	-	7	-	-	-	-	-	8	-	8	8	-	8
Virginia	1920	5	10	5	5	10	5	8	15	7	8	15	7	8	15	7	-	-	-	8	15	7
West Virginia	1921	5	-	-	7	-	-	7	-	-	7	-	-	8	-	-	-	-	-	7	-	-
Wisconsin	1922	-	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-
Wyoming	1919	10	-	-	-	-	-	10	-	-	-	-	-	8	-	10	-	-	-	8	-	-

(1) Trap-gravite-limestone
(2) Trap rock
(3) Trap-granite-quartzite
(4) If trap, quartzite or granite, shall contain not more than 15% soft stone. Such soft stone to have a Fr. coef. of not less than 8. If limestone, shall have an average Fr. coef. of not less than 7, with not more than 5% material having a Fr. coef. as low as 5.
(5) Limestone
(6) Trap or limestone
(7) Trap or granite
(8) Concrete must have a crushing strength in 1:2:4 mix of at least 2,000 lbs. per sq. in. at 28 days
(9) Any material except trap rock
(10) Dolomite
(11) Granite, gneiss, sandstone, or quartzite
(12) For certain types of construction, limestone must have a crushing strength of 17,500 lbs. per sq.in., other rock types 15,000 lbs. per sq.in.
(13) Material must have a crushing strength of at least 9,500 lbs. per sq.in.
(14) Material must have a crushing strength of at least 15,000 lbs. per sq.in.
(15) Material must have a crushing strength of at least 20,000 lbs. per sq. in.

NOTE: In New York, stone for use in Federal Aid work must have a Fr. coef. of at least 7.

As has been noted, the present practice regarding the physical test limits for rock tends to omit limits for hardness and toughness and to depend upon the abrasion test alone. Of the 39 states listed in this table only 13 have limits for toughness and only four limits for hardness for stone to be used in concrete wearing course. About the same ratio obtains for the other types of roads listed.

Tendency to Revise Downwards

A study of the specifications from which the information given in Table I was taken as compared with older specifications of the states shows that there is a tendency in certain sections to revise downward the test limits for crushed stone. This is particularly true in those states in which high-grade rock cannot be obtained. This fact would indicate that the specification writers are not adhering so rigidly to engineering practice of other states as was at one time the custom, but are drawing their own requirements based on their own experience with local materials.

In Table II requirements are given for percentage of wear of gravel for various types of construction for those states which have set test limits for this material. Due to the fact that the abrasion test for gravel has never been generally recognized as entirely satisfactory, many states prefer to omit definite test limits for quality for this material. It will be observed that in this table percentages of wear are reported instead of French coefficients of wear. This is done because the test as applied to gravel is somewhat different from the Deval abrasion test. The test as now conducted has been used by the state of Ohio for a number of years. An 11-lb. sample of the gravel to be tested graded uniformly from 2 to ½ in. size is placed in the standard Deval cylinder, together with an abrasive charge consisting of six 1¾-in. cast-iron balls. The charge is given the standard run of 10,000 revolutions and the percentage of material which will pass a 16-mesh sieve is reported as the percentage of wear.

While there is no direct relation between the percentage of wear of stone tested by the standard method and gravel of equal quality tested by the modified method, a number of tests which the Bureau of Public Roads has made would indicate that, in general, gravel of equal quality to crushed stone will show a percentage of wear about three times as great. In other words, gravel with a percentage of wear of 15 will be approximately equal in quality to stone with a percentage of wear of 5.

Referring to Table II, it will be noted that with the exception of one state, Oregon, an average requirement of either 10 or 12 per cent wear is specified for pavements, while as high as 25 per cent less is allowed in one case for aggregate for concrete base. Here, again, the tendency for the states to set limits which will utilize the best material available may be observed. Oregon, for instance, is able to secure readily gravel with a percentage of wear as low as 5, a value which would rule out almost all of the available material in Ohio.

In conclusion, the writer wishes again to emphasize the fact that the specification limits given in Tables I and II cover only the requirements which are found in specifications approved for Federal Aid work. There are, of course, many other specifications—both state, county and municipal—which have not been included in this discussion.

TABLE II—MAXIMUM REQUIREMENTS FOR PER CENT WEAR OF GRAVEL FOR VARIOUS TYPES OF CONSTRUCTION—BY STATES

State	Date Approved	FOUNDATION Cement Concrete	FOUNDATION Waterbound	SURFACE COURSES Bituminous Concrete	SURFACE COURSES Cement Concrete
Kentucky	1922	12	12	12	12
Maine	1922	....	15	....	10
Minnesota	1921	12	....	....	10
New Hampshire	.....	....	10	....	....
North Carolina	1922	10	....	....	10
Ohio	1922	25	....	12	12
Oregon	1922	....	....	5	5
West Virginia	1921	15	....	....	....

Cement Contract Awarded by Indiana Commission

THE Indiana Highway Commission recently discussed buying the rest of the cement needed in its 1923 hard-surfacing program, according to Director John D. Williams.

Contracts for 100,000 bbl. were let in December at prices from $1.70 to $1.90 a barrel, f.o.b. While these prices were regarded as too high, the commission saw no way to change the situation and awarded the contracts necessary for beginning this year's paving program.

Recently the Universal Cement Co. announced a reduction of 15 cents a barrel and the commission was notified that the reduction would apply to the contracts let in December. In view of this reduction, the commission discussed calling for bids on the additional 500,000 bbl. needed for about 150 miles of roads in this year's program.

Last year the commission used nearly 500,000 bbl. The reduction will mean a saving of nearly $100,000 on the paving program this year.

Immigration Committee of National Crushed Stone Association at Washington

PURSUANT with the vote of the Chicago convention, President F. W. Schmidt, Secretary A. P. Sandles, B. D. Pierce, Jr., president of the Connecticut Quarries Co., and Otho M. Graves, assistant to the president of the General Crushed Stone Co., representing the Immigration Committee of the National Crushed Stone Association, met in Washington, D. C., January 30, and were successful in obtaining hearings before the immigration committees of both houses of Congress. A. Acton Hall, president of the Ohio Marble Co., also a member of the committee, arrived in time to take part in some of the conferences.

Although the hearings before the congressional committees had officially closed, the representatives of the quarry industry were permitted to present their case under most favorable circumstances; and they did so most convincingly. Nevertheless, there does not appear—from recent press despatches—to be much hope of liberalizing the present immigration laws.

Market for Cement in East Africa

ANNUAL imports of building cement into Portuguese East Africa amount to nearly 10,000 tons. The material is used principally by the railways, but a large proportion is employed for residences in the larger towns.

The greater part of the cement is purchased from the Transvaal, but quantities are imported from Germany and Great Britain. A small amount comes from the United States, but the freight differential and lack of return cargoes renders it difficult for the American article to compete. In addition, the territory of Mozambique Co. imports for its own use about 1500 tons annually, says Consul Cecil M. P. Cross, Laurence Marques, in a report to the Department of Commerce.

Production Costs of Rock Products

By Oliver Bowles

No. 4—This Article Relates to Economies to Be Brought About Through the Best Use of the Raw Materials. The Field Offers Cost-Reducing Possibilities Beyond Many Operators' Estimates

THE first and second articles of this series outlined the advantages that result to both producer and consumer through reduced production costs, and dealt with general methods by which such reductions might be accomplished. In the third article the largest single item of quarry cost, that of rock loading, was considered in some detail.

Thin-sheeted Maine granite utilized to good advantage for paving stones

This article relates to economies that may be brought about through utilizing raw materials in the best possible manner. It relates to methods of operation within the quarry, to the best application of major products, and to extended uses for waste materials. This neglected field offers possibilities of reducing costs far beyond the present estimate of many operators.

Improved Utilization Within the Quarry

The problem of maximum use begins with the natural ledge of rock. A deposit of limestone, granite, slate, or other rock is chosen for exploitation because it has exceptional qualities, but even the best of rock deposits possess inherent weaknesses that must be regarded in the quarrying process. The problem of maximum use relates primarily to methods of so removing the rock that the natural defects will impair the product as little as possible. The cost of removing waste material is approximately as great as the cost of quarrying good stone, and therefore any increase in the proportion of good rock removed reduces the cost per unit of the product.

The imperfections to which consideration must be given may be chemical or physical. Where the rock is removed in regular blocks, and cut to various structural forms, physical defects are of as great or even greater importance than the chemical, but where it is used for products such as lime, fluxing stone or refractories, chemical defects have a profound influence. Consideration will first be given to some of the methods of dealing with physical defects to best advantage.

Economies in Dealing with Physical Defects

In marble, limestone, granite and sandstone deposits joints or cracks may intersect the rock mass. Many of them are closed seams, almost invisible to the naked eye, but constituting planes of weakness that would lead to speedy disintegration of any rock mass that they intersect. As blocks must be free of them great care should be exercised in quarrying, and the quarryman's first duty is to make his planes of separation parallel, and, so far as possible, coincident with seams, so as to produce sound blocks of maximum size.

Marbles commonly differ in character or quality in passing from one bed to another, and it may be advisable to separate the mass at intervals parallel with

Piles of waste granite at a Vermont quarry

the bedding in order properly to classify and grade the product. An accompanying illustration shows the separation of a mass in an oblique direction, because the bedding is inclined at a steep angle, and the marble is of a different character on either side of the line of drill holes. While angular blocks are undesirable, it is deemed wise to cut them obliquely rather than to have diverse materials in the same block.

In quarrying slate the same principle holds that all major separations should be made parallel with the characteristic structures such as joints, ribbons, slaty cleavage or grain. Another means of obtaining a maximum utilization of available slate is to use a limited amount of explosive, substituting therefor either wedging or channeling, for thus the quarryman may avoid losses by shattering, and further losses through the production of irregular angular fragments that cut to poor advantage.

Variations in Chemical Composition

In the rough stone industries rock structures and other physical properties have a smaller influence on maximum use, but chemical composition may be of paramount importance. In the quarry process an important probelm in proper utilization of available stone is to separate the major rock types that differ from each other in chemical composition and thus may be applied to different uses. Usually, rock in a single bed is fairly uniform, the greatest variations occurring in passing from one bed to another. Hence the separations must be made along bedding planes. Where the beds are horizontal this is comparatively simple, for ledge by itself becomes more complex.

It may be necessary to work on inclined benches, utilizing open bed planes for bench floors. Where the good beds are vertical or stand at steep angles, much

An example of very efficient use of sandstone within the quarry

waste rock way be removed with the high-grade material, and thus production costs will be high. Some operators have found it best to mine rather than quarry rock that occurs in steeply inclined beds, so as to handle a minimum of waste.

An example of waste of sandstone within the quarry

the upper beds may be quarried first, and the lower beds worked later as a second bench. Where the beds are inclined the process of quarrying each

Clean stripping is an important factor, for if dirt is mixed with the stone, large quantities of good rock may be discarded with the quarry waste.

Improved Use of Quarried Materials

A high production cost is commonly due to the fact that only a small percentage of gross production is made use of. The quarryman may prepare a single product only, and its exacting requirements may rule out most of the material available. Where only one-tenth of the rock quarried is used, the cost of production of each nine tons of waste must be added to the cost of each single ton used. It is therefore a problem of vast importance to discover means of extending the field of utilization so as to embrace a large, or even a small, part of this seemingly useless mass. One way in which this may be accomplished is by manufacturing a greater variety of products.

An Era of Extended Uses

In the early days of civilization each natural product was greatly restricted in its uses. There was little competition between commodities because each commodity was confined to one or two uses only. Thus roofs of human dwellings were made chiefly of wood, and floors of the natural soil. In recent years there has been a growing tendency to find new and wider uses for each commodity, and a great number of different materials are used for the same purpose. Now a roof may be made of wood, sheet metal, copper or zinc shingles, slate, tar and gravel, tile, asbestos shingles or composition rolled roofing, and floors may be made of wood, concrete, tile, terrazzo, oxychloride cement and various other compounds.

The growth of new uses is a mark of progress. Innumerable useful articles are now available that a few decades ago were unknown. The application of limestone and clay to the manufacture of portland cement, and the use of dolomite for furnace linings and magnesia pipe covering are examples of the application of very commonplace rocks to important special uses.

It is this growing tendency for each product to encroach on the field formerly held exclusively by some other product that has led to the development of the trade association, an organization primarily to protect an industry, to maintain its strength in its recognized field and, if possible, to extend its sway in other fields of usefulness.

The trade association is an outgrowth of competition between entire industries rather than the earlier type of competition which was directed by each individual concern against its neighbor manufacturing the same product. One function

of the trade association is to develop new products and to extend their uses.

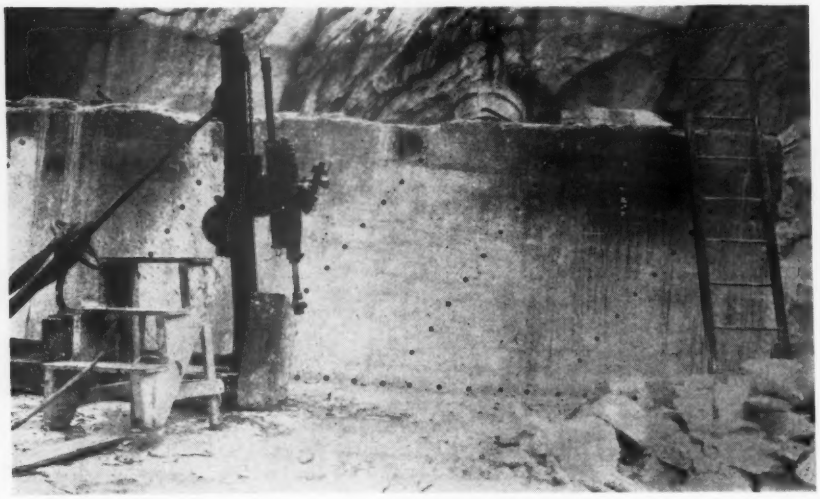
Broader Use of Major Products

The field of broader utilization offers tremendous possibilities in reducing costs. In certain instances it may not be wise to extend the application of a raw material beyond a single use. For example, where a limestone is used for cement manufacture, an attempt to extend its use in other fields would probably result only in a useless dissipation of energy. Even here, however, there is opportunity for special application: For example a very pure ledge of limestone might be separated and used for the manufacture of a high-priced white cement.

In many of the stone industries an extension of the variety of products would tend to reduce costs greatly. This has been proven in the slate industry, for companies that eked out a precarious livelihood producing roofing slates only have developed a more prosperous business by producing blackboards and structural and electrical slate in addition to the original product.

Marbles of a great many varieties may occur in a single deposit. Some of them are adapted for decorative carving, others for structural blocks, and others for monuments. Through careful selection and classification the purchaser obtains a better product, and the producer is enabled to use his material to the best advantage. Without such classification the high-grade marble may be so associated with the lower grades that it can be marketed only at the low-grade price, while the cheaper grades may be so lacking in uniformity as to reduce the price or even lead to partial rejections.

Some of the veined marbles will command a higher price if cut in certain directions that show to best advantage the beauty of the markings. By thus catering to the artistic taste of the architect the marble producer may greatly enhance the price of his product, with little or no additional cost. In this and similar cases the production cost is not actually reduced, but the equivalent of a reduction in cost has been effected.



Splitting marble along inclined bed planes in order to use it to best advantage

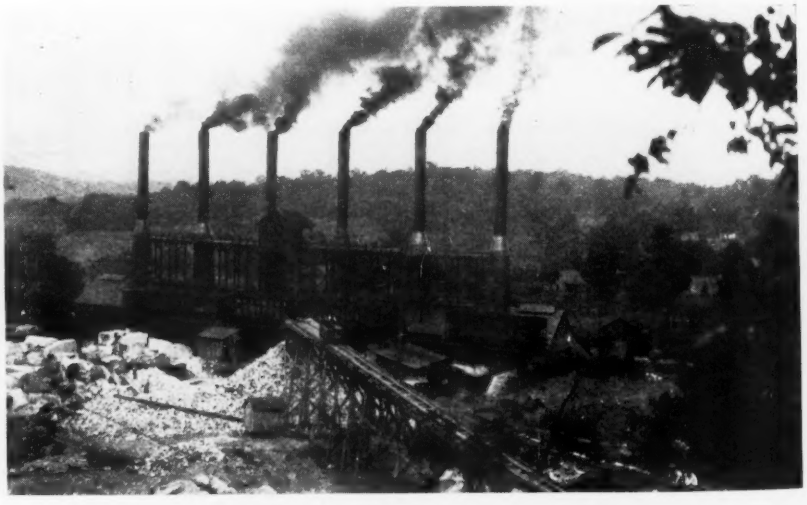
In the monumental granite industry a vast amount of rock is discarded as unsuited to the exacting demands of the trade. Mountainous heaps of rejected blocks are characteristic of most monumental granite regions. Many of these blocks would make dimension stone, excellent in quality, and attractive in appearance. Thus a granite quarryman could use his materials much more fully by making monuments from the very highest grades, and building stone or curbstones from the less uniform grades. Few quarrymen realize the advantage of diversity in products sufficiently to induce them to broaden their activities and thus avoid adding the cost of production of immense waste heaps to the cost of the small part of total quarry output now utilized.

Waste Utilization

In many of the stone industries the proportion of waste is so great that the expense of handling it is an important item in production cost. Extraordinary efforts are being made to take care of the waste, for keen competition demands economy, and this is a fruitful field for eliminating much of the expense of waste disposal. It is advisable to utilize as much as possible of the rock for the main quarry product, for the reason that most operators are reluctant to undertake the manufacture of byproducts, as such enterprises lead them into new marketing fields with which they are unfamiliar.

In most branches of the stone industry, however, large quantities of raw materials are unsuited for the major products, and any methods of utilization that will yield even a part of the cost of production are greatly to be desired. Some companies have been very successful in developing byproduct industries, and their profits have increased proportionately.

The uses of waste stone of one kind may suggest possible new applications of some other type of waste rock. Therefore, a brief review of the main outlets for waste in each branch of the stone industry is given in the following paragraphs; it may serve as an incentive for the wider development of byproducts.



A battery of lime kilns using waste marble at a Tennessee quarry

Uses for Limestone and Marble Waste

Limestone is one of the most valuable

rocks in nature on account of its active chemical properties, and in consequence its numerous applications in industry. The proportion of waste is variable in different branches of the industry. At cement plants there is little if any waste. At crushed stone, lime, and fluxing quarries spalls and fines constitute the chief sources of waste. They may be made use of by burning in rotary kilns to make lime; by grinding for agricultural lime, poultry grit, and for filler in asphalt, rubber, etc. Small fragments are sold for road stone and concrete aggregate.

Marble having the same chemical composition as limestone may be used in the same ways. Waste blocks, unsuited for building purposes, are burned into lime in some localities. They may also be used as riprap for harbor work, shore protection, or railroad fills. Fragments of attractive colors are crushed to small sizes for terrazzo flooring. If located near blast furnaces, waste blocks may be broken up and sold as flux. Pulverized marble is, like limestone, sold for agricultural uses, and another product, whiting substitute, is prepared by extremely fine grinding. Efforts have been made to use small slabs of marble for facing concrete blocks, but such methods have never attained importance.

Uses of Sandstone Waste

Sandstone consisting almost entirely of silica is chemically inert, and in consequence is somewhat restricted in its applications, though its abrasive qualities may be capitalized to some extent. Large masses of waste may, like marble or granite, be used for riprap. Small masses may be trimmed roughly to rectangular shape for foundation stone, or may be more carefully trimmed to standard sizes for broken ashler wall rock. Crushed sandstone is used to a limited extent in road bases and as concrete aggregate. When crushed to sand it is used locally for the manufacture of sand-lime brick. Where sandstones are inclined to be friable, large quantities of sand accumulate as a result of quarrying and manufacturing processes, a product which is largely wasted but which finds limited use as building, engine or foundry sand.

Uses of Granite Waste

If quarries are conveniently located, large masses may be used as riprap. Waste blocks may be used locally as wall stone, but on account of transportation expense this use is very limited. An effort has been made to use fine materials in the same way as sand in the manufacture of brick similar to sand-lime brick. The extensive program of road building now being undertaken in many parts of the country has encouraged granite companies to erect crushing plants for the manufacture of road stone from waste, a use for which it is admirably adapted.

Uses for Slate Waste

As the proportion of waste at slate quarries is very high, unusual efforts have been made to develop uses for it. Waste fragments are used for wall rock, fence posts, sidewalks and flagging. To some extent, small pieces are manufactured into novelties, or are used as inlaid slate with a backing of composition roofing. A small amount of waste is used for granules to make slate-surfaced composition roofing, though most granules are made of rock quarried expressly for this purpose. There is a growing demand for slate in pulverized form as filler in road asphalt, roofing mastic, linoleum, oilcloth, rubber and paint. This is one of the most promising outlets for waste in the slate industry.

Van Zandt to Return to United States

UNDER date of January 8, writing from Yokohama, Japan, Paul C. Van Zandt informs ROCK PRODUCTS that he will sail on the "Hakone Maru" from Yokohama on March 1, and will arrive in Marseilles on April 7. He will leave Yokohama a few days earlier to visit the Philippines and then catch the through boat at Hongkong. His stay in Paris will terminate early in June and he will reach New York about the first of July.

Paul C. Van Zandt

Mr. Van Zandt will not renew his contract with the Asano Portland Cement Co., Tokyo, Japan. He anticipates remaining in the United States with his family and his boys, who are outgrowing the Yokohama schools.

Research on Molding Sands

THE committee on molding sand research, under the guidance of the Division of Engineering of National Research Council and American Foundrymen's Association, has made progress in its program of research. Many firms, universities, governmental departments and individuals are cooperating in this work. The investigation was made possible through an appropriation to the American Foundrymen's Association, which was later supplemented by National Research Council.

The subcommittee on geological surveys has prepared for the use of the state geological surveys, standard methods of making surveys of molding sand resources and preparing test samples. Some satisfactory deposits, worked for years, are deteriorating, while others are being seriously depleted. Excessive freight charges being paid by foundrymen to get sand from long distances may possibly be avoided by making available deposits now undeveloped which are near at hand.

Illinois, Virginia, Maryland, Alabama, Florida, Pennsylvania, Tennessee and New Jersey are already co-operating. Standardization of tests for determining size, shape, cohesiveness, permeability, water content, thermal properties, analyses (including rational, chemical, mineralogical), are still under way and some of them completed.

The subcommittee on conservation and reclamation has mailed 7500 questionnaires to gray iron, non-ferrous, steel and malleable foundries to obtain information on the proportions of sand reclaimed and methods of reclamation. The Ohio Brass Co. is making investigations for the use of clay in retaining bond strength in molding sand heaps. The Sivyer Steel Casting Co., Milwaukee, is studying the effect of clay additions on the grain size of sand heaps. The American Steel Foundries has reported on the method and equipment designed, which permits a recovery of about 70 per cent of refuse sand used in steel foundry work.

Highway Traffic Convention Postponed

THE 1923 convention of the National Highway Traffic Association, which was to have been held in Cleveland, Ohio, on February 19 and 20, has been postponed.

Your Income Tax

Illuminating and Comprehensive Paper Before the Annual Convention of the National Sand and Gravel Association. Depletion Allowances Explained in Detail—Value of Limestone Quarry Property

By C. C. Griggs
Chief, Non-Metals Valuation Section, Income Tax Unit,
U. S. Department of the Treasury, Washington, D. C.

MR. PRESIDENT and members: I esteem it an honor and a pleasure to be able to address this meeting of the National Sand and Gravel Association. It is an honor, for I well realize that a gathering of representatives and successful men who have many affairs to occupy their attention would not care to use their time unless they thought I might have a message worth while. It is a pleasure, for in my contact with the taxpayers representing the various lines of endeavor coming under the non-metals classification, I find that when I can sit down and talk face to face with them, it does not take long to come to a complete understanding about tax matters. Anything that will tend to clear up a certain degree of misunderstanding which seems to exist concerning the methods used by the government in collecting taxes is a pleasure to me.

(I wish to apologize for using a manuscript in this address, but as the department usually censors all papers before they are delivered, or any addresses, of course this paper has been approved and I would prefer to stay strictly to the manuscript. So I will ask you to pardon me for reading the address.)

To illustrate what I mean about this "misunderstanding" I will quote two articles appearing recently in the daily papers. The first appeared in large type headlines as follows:

SAYS INCOME TAX MAKES U. S. A NATION OF LIARS

Boston, Nov. 17—Methods used by authorities in collecting the Federal income tax have made the American people a nation of liars, Prof. Charles J. Bullock, of Harvard University, said in an address at the New England tax conference.

He said that the morale of the people had been lowered through efforts of Federal authorities to collect taxes on a 100-per cent efficiency basis, declaring that the income levy might be regarded as a "gentleman's tax," and voicing the opinion that the people resent any attitude on the part of the government which casts doubt on their honesty.

The second appeared still more recently, and was by that capable and refreshing K. C. B., whose articles alone, at any time, are worth the price of the paper in which they appear:

YE TOWNE GOSSIP

Copyright, 1922, by Star Company
By K. C. B.

WHEN I looked out,
ON the army of clerks,
THAT IS sitting down,
IN WASHINGTON,
AND SEARCHING through
THE INCOME blanks,
THAT YOU AND I,
HAVE SENT to them,
AND UNDER oath,
HAVE SIGNED our names,
THERE CAME TO ME,
WHAT LINCOLN SAID,
OF OUR Government,
"BY THE people,
"AND OF the people,
"AND FOR the people,"
AND SOMEHOW or other,
IT DID Seem strange,
THAT YOU and I,
SHOULD EVERY year,
ON MARCH 15,
SIT DOWN and swear,
JUST WHAT WE'D earned,
IN THE year before,
AND AFTER that,
WE'D HIRE an army,
OF HAWK-EYED clerks,
AND BUILD a building
WITH THOUSANDS OF desks,
AND TYPING machines,
AND TAKE the clerks,
AND SAY to them,
IT WAS their duty,
TO SEE to it,
WE HADN'T lied,
IT SEEMS so silly,
TO DO THIS thing,
AND STILL I know,
IF WE didn't do it,
WE'D PROBABLY lie,
A WHOLE lot more,
THAN WE do today,
AND WHATEVER the answer,
I DON'T know,
EXCEPT THAT I know,
THAT WHEN A people,
CAN'T TRUST themselves,
THERE'S SOMETHING the matter,
THAT SHOULDN'T be,
AND FOR MYSELF,
I WANT to say,
WHOEVER IT was,
THAT MADE the discovery,
I STILL owe money,
FOR THREE years ago,
HE MAKES me sick.
I THANK YOU.

The government is no nearer being 100 per cent efficient in collecting the income taxes due it than you gentlemen are in collecting the money due you from your own operations. If such a thing were possible, there would be no occasion of providing in your income tax returns for such a contingency by permitting you to write off, tax free, bad debts. In all efforts made by the government in collecting tax a conscientious personnel, with due regard to the law, review the returns. Should errors be apparent, through mistakes and misunderstandings, the taxpayer is notified. I see no more reason why exceptions should be taken to the government's checking up its business than there would be to the taxpayer's checking up his own financial undertakings.

If the taxpayers could come to Washington (as many do), take up their own cases and consult this "army of clerks." I am sure they would have an entirely different understanding of government methods. I know this is impossible in many cases, therefore an opportunity such as is presented to me now should be welcomed by any government official concerned in the collection of tax.

Undoubtedly a great deal of perplexity has resulted from the misinterpretation of the income tax laws. In fact, so much confusion has resulted from one phase, namely, the excess profits tax, that Congress has repealed it in its entirety. In the future this law may be forgotten by the taxpayer in making out his income tax returns. However, since it takes five years for returns to outlaw after they are filed, it is still a live matter for past years and questions concerning invested capital will be discussed for several years to come.

How many members of this association have had trouble in establishing their values for invested capital? Many, I dare say. You doubtless were relieved when Congress repealed this law. While the law itself consists of only a few pages, volumes have been written explaining it. It would not be difficult to compile an entire address covering this one phase alone, but since there are other things to be considered in making out your income tax returns I will drop this feature of the law and confine myself to live matters which will concern you, not only when you file them on March 15 but most probably for many years to come, as the war is a long way from being paid for yet.

Depletion Allowances

You all know that March 1, 1913, was adopted as the basic date for establishing valuations for depletion purposes and also to determine the profit or loss in selling or disposing of your capital assets. You also know that the unit rate of depletion is determined by dividing the market value of the property at that date, if acquired prior thereto (or the cost if acquired subsequently), by the number of units contained in the deposit. You also are aware that a leasehold has no value for establishing depletion above the bonus paid for it.

It is evident that the correct determina-

tion of the March 1, 1913, value of the property is of major importance in computing the tax due the government. The regulations say that an appraisal made at that time, if consisting of a real appraisal and not merely an expression of opinion, shall be given due consideration. Since few were made at that time, and both the taxpayers and the government realized the necessity of having one, the laws provide for appraisals reflecting conditions known to exist as at that date, and establishing the true market value, or such a value as a willing purchaser would pay a willing seller for the property. This "market value" reflecting the "cost or replacement" value as at that time.

There has been so much misunderstanding as to just what is meant by an "appraisal," and since this feature is a little different in connection with your line of operations than in some other lines of industry, I will endeavor to explain to you the meaning of the term.

Appraisals—An Example of a Limestone Deposit

Not long ago a representative of a large brokerage concern said his house was contemplating putting a large issue of bonds on the market for a successful limestone company that desired to increase its output. The proceeds from the sale of bonds was intended to provide additional plant, equipment, and shipping facilities. He stated that his house has always been conservative and hesitated to place any bonds unless they were assured that the company owned assets which at a forced sale would amply protect the bond holders. Two prominent engineers had made appraisals of the limestone deposit, and on account of the exceptional purity of the limestone they had both agreed that the deposit was worth at least 10 cents per ton in place.

The deposit being large, represented more than a million dollars in value. While he recognized the good faith of the engineers, he was not quite satisfied with the accuracy of their reports, so he came to Washington. Before he came in to see me he had consulted two other engineers in this city, who had placed values of 10 cents and 25 cents per ton on the limestone, calculated from his figures representing the profits of the company in question.

This man being ultra-conservative, still was not satisfied, and in placing the proposition before me asked me to tell him what I, as an engineer, would report in such a matter.

It must be borne in mind that the name of the company or its location was not mentioned. Had he told me either, I should not have been at liberty to discuss it with him, but since I could advise him in a general way, I was glad to do so. I therefore outlined to him much in the following manner just what I as an engineer would do had I been consulted in the matter.

Estimating the Value of Limestone in Place

I told him the statement that limestone is worth 10 cents per ton meant nothing unless supported by substantiating figures, which any other engineer could check and approve. It is the duty of the engineer to investigate the business. The first thing would be to ascertain whether the company had acquired all the limestone available in that district. The next, to see if the market would justify an expansion of the business. This would have to be done by establishing the extreme limits for shipping the product without trespassing upon his competitor's territory. It would then be an easy matter to estimate the market requirements for his district, and a reasonably safe percentage could be allowed for growth in population.

The next step would be to check up the profits of the company and estimate the cost of operations to be expected from an increased production of material. Then, by properly analyzing all these factors, it could be very easily determined whether the contemplated issue of bonds would be justified. As for the value of limestone, I told him it had no value more than the cost of the raw land, or at the most the developed quarry. For example: "Suppose the company failed, and you were depending upon selling the 'quick' assets, what would you expect to realize from your mountain of limestone?" He replied, "We would be lucky to get $5000 for it."

He was quite disturbed over this logical conclusion, and remarked: "Well, then, I don't see how my house can recommend the sale of those bonds." I then hastened to tell him that if an engineer would make a favorable report under these conditions, he would not only be perfectly safe in handling the bonds, but infinitely better off, than to accept the basis previously outlined to him, I, personally, would not hesitate to invest all the money I have in a sound business with such a report by a reputable engineer.

Another man came to me with an entirely different proposition. This one was a somewhat smaller undertaking, but since the deposit was large and had an apparent life of many years, with the usual promise of expansion, he asked me what value I would place on the property as he contemplated purchasing it.

Again I knew nothing whatever of the name of the company or its location. (I may add right here, that in the illustrations I use, I am not alluding to any particular properties with these two exceptions.) My visitor stated that the company had shown a net income of about $20,000 a year. I learned that this was not the only deposit available in that territory, but there were numerous others operating in competition, and any amount of ground was to be had at a very small price per acre, with every promise of being fully as good as the one in question.

I told him that while this property represented a "going concern," and had an admitted value, he could not afford to pay the owners more than $80,000 for the entire business, not including the plant and equipment. (The plant and equipment could be appraised for what they would be worth to him.)

My suggestion was somewhat of a surprise, for the price proposed was very much in excess of this figure. I further suggested that rather than pay in excess of $80,000 it would be advisable to purchase some of the cheap land adjoining, and use that amount in developing the new quarry and establishing his own business.

One more illustration: Suppose a big company purchased a property for $2,000,000, then had to put a plant and equipment on it costing another $4,000,000. They are able to pay $250,000 a year in dividends. It will take at least 40 years to exhaust the supply of raw material. At first sight, this would appear to be a good investment, but in reality it is a very poor one for, the same amount of money at compound interest would return as much, with no worries incidental to conducting the business and with no risk.

These illustrations are given to outline in a way what is meant when the government uses the term "market value."

Leasehold

Just one example to explain why a leasehold has no more value for income tax purposes than the bonus paid for it. Suppose one of you owned a leasehold running for 10 years on which you are paying 3 cents per ton royalty, and are making 20 cents per ton profit (profit meaning in this case the income before deducting depletion and depreciation). As lessee you do not own the mineral; you have merely the privilege to extract it. This leasehold costs you nothing, and you have a reasonable assurance that you will have extensions of time at the expiration of the 10-year period, and you consider this leasehold to have a real value to you.

Suppose you estimated this value to be $100,000, and, based on your output, some engineer has so computed it. If this value were established, you would be entitled to amortize this leasehold through the 10-year period, at the rate of $10,000 a year. If this reflected 10 cents per ton on your output, you would be writing off 13 cents per ton (amortization plus royalty) as a tax-free deduction. By the time your depreciation and other permissible deductions had been writ-

ten off, you would have very little income left on which to pay taxes. This would be manifestly unfair not only to the government, but to the ones who owned the fee title to the property as well.

The chances are that the lessor who owned the property would not be entitled to write off more than 1 cent per ton as depletion, the remaining 2 cents from the royalty representing the profit to be reported on his returns. Therefore, it would be entirely unjust to allow the lessee such a deduction on his returns.

It is very doubtful whether an engineer would report the advisability of one purchasing the leasehold at that figure. If someone did purchase it, the seller would be expected to report the entire amount received as profit in the transaction. The purchaser then in that event would be entitled to the price paid as a valuation, for the purchase price would represent bonus paid for the lease.

Royalty

A few words relative to the bearing that royalties have to the value of deposits: While it is recognized that leases are given requiring a unit rate of royalty, these in no wise reflect the value of the deposit. As explained before, the unit value is determined by dividing the cost of the property, or its market value by the number of tons contained therein, while royalties are determined by the amount a lessee is willing to pay a lessor for the privilege of entering into temporary possession of the premises and removing the material.

It is obvious that the lessor will not permit anyone to remove the material at the actual cost of the product. He will, naturally, expect some compensation for the damage which may be done to the premises and to have a profit remaining in the transaction.

The amount of royalty paid is usually a matter of adjustment and agreement between the lessor and lessee and factors enter into the deal that have no bearing on the actual value of the deposit in place. Where numerous leases have been given in a certain district all running uniformly, and these have been the result of many years' adjustments between lessors and lessees, they may be accepted as indicative of what the value of the product is, by making the proper allowances for profit and the damages to the land resulting from the removal of the natural resources. Even so, however, the engineer accepting these values will do so with proper reservations, and will prefer to check the results with transactions of as nearly parallel conditions as possible, where an actual bona-fide deal has been made reflecting the true unit value of the deposit.

Management and Contracts

Good management and favorable conditions also enter into consideration in determining the value of a "going business." Suppose that you and I each put in $10,000 to buy a sand and gravel pit. We are able to obtain favorable contracts (and deliver the goods, for we will use trucks and not depend upon freight cars), and we clean up $100,000 the first year, with a possibility of having many such years repeated.

If someone wished to buy us out, it is safe to say that we would not sell him our business for the $20,000 we have invested in the sand and gravel, but would expect much more than that. However, supposing there are other deposits available, we are not entitled to any more for depletion than was represented in the original cost. In this case, it is not the sand and gravel that gives the selling value, but the contracts we hold and our business ability which forestall competition.

Discounted Earnings

I believe with the few illustrations noted you will have an idea of what is involved in valuations for income tax purposes. Since undoubtedly you have all been advised that the government at times permits the so-called "discounted earnings" method of valuing deposits, I will outline briefly what is meant by the term, and also explain why it is not applicable to such deposits as sand and gravel.

The "discounted earnings" method is intended to reflect the price which one could pay for a proposition, and be assured of having a proper return of his money distributed over the life of the property, the money thus received to be placed in a sinking fund drawing 4 per cent interest. In other words, we as engineers would resort to this method if no other way presented itself to be able to say what value a property would have to a probable purchaser to represent a good investment.

The first consideration would be, what rate of interest should we expect for the money invested? This is also known as the risk rate, for the risk or hazard in the operation would determine what we should expect from the investment. For instance, if we contemplated an investment in an underground mine, with a deep shaft, danger of caves and fire, we would undoubtedly expect a higher rate of interest on our money for taking the risk incident to such an operation than from operating a sand and gravel deposit consisting of outside work, with no definite hazard. For sand and gravel we would expect 10 per cent.

Then, estimating the number of tons of material we would produce in the operating life of the property, and knowing the profit per ton, we very readily ascertain the entire profit anticipated from the business. By means of Hoskold's Tables, adopted by the government, the amount of money which would return the rate of interest decided upon, together with the interest accumulated from the sinking fund compounded annually at 4 per cent is easily determined. This amount represents the sum of money which we could place in a bank under the same interest conditions to produce a like result.

There is another factor to be considered; that is the plant and equipment necessary to carry on the operations constituting an additional investment. Obviously, the money tied up in these has to be returned in the same way, so before any allocation is made to mineral the price of this equipment has to be deducted from the amount. In case of long life of the property, the value of plant and equipment may be multiplied three or four times through replacement and depreciation, so in considering the proposition from an investment standpoint it becomes necessary to deduct the multiplied value of the plant and equipment.

It is surprising how many times this method results in no value at all for mineral, when the computations are carried through properly. This is principally due to the small unit profit and to the long life of the deposit in such operations as sand and gravel and limestone.

Discounted earnings is purely a speculative method, and where properties are being purchased nearly every day, and farm land values usually attach, it is not difficult to determine about what the market value is without resorting to such theoretical methods. Again, one company making exceptional profits, due to business ability, favorable contracts or other factors, may make a larger per unit profit and be benefited accordingly, which would place his struggling competitor at a disadvantage while the market value of the sand and gravel deposit would be the same.

In mines producing the rarer materials where the deposit is limited, this method is much more satisfactory. In these cases, as a rule, the life of the property is comparatively short; there are not so many renewals of plant and equipment; the prices are more fixed; the sale of the product assured, and uncertainties do not creep into it as in the sand and gravel business and several other of the non-metal industries.

Manufacturing Industries

The foregoing remarks apply to natural resources that have a market value as they are removed. In a few industries—cement, gypsum, stoneware, brick and tiling—the market value lies in the manufactured product. The prices received for the finished articles (having to include the cost of the manufacturing process) are out of proportion to the value of the raw material from which they are made. Obviously, the discounted earning method could not be applied to these industries unless due allowance is made for manufacturing.

As one engineer aptly expressed it, "One could no more discount the earnings from a manufacturing industry, to determine the value of the clay from which the articles are made, than he could discount the profit from the sale of shoes to determine the value of the cowhide."

Discovery Value

Discovery implies "surprise," and is intended to apply to such things as encountering oil or some mineral the presence of

which was absolutely unknown. It would not be recognized as a discovery when a sand and gravel company purchases adjoining land and then "finds" sand and gravel on the property. It is assumed this was known before the deal was made, and surprise would have resulted had the sand and gravel *not* been "discovered."

While I have endeavored in this article to touch upon the "high points" concerning valuations as applied to income tax, it is evident that there are many other items to be considered, and many factors that enter therein. No two cases are exactly the same. Jones and Brown may be neighbors in the same line of business, but when the returns come in Jones may have a comparatively simple case which is quickly adjusted, while Brown may have so many ramifications that it would be difficult to believe they were even in the same country. From the few complexities I have mentioned I am sure you will agree with me that Uncle Sam has a real job in adjusting the income tax and needs his "army of hawk-eyed clerks."

What Is an Appraisal?

And now, to epitomize, we find that an aggregation of logical data, establishing the investment value of any proposition, is an appraisal. A mere statement that a deposit is worth a certain sum of money would not suffice. The government engineers are placed in the same position in reviewing income tax returns as they would be were they called upon to appraise a contemplated investment. The sum that one can conscientiously report to such a principal would be the amount recommended as the market value of the property, or that sum which a "willing purchaser would pay a willing seller." It may be a surprise to you members to learn that in every case handled by the government an appraisal has been made of your property, and when your claims have been allowed, where the valuation has had to be determined by theoretical methods (I mean by this where the payment was not made in cash), it may be some satisfaction to you to know that your business has justified the valuation approved as reflecting a fair investment value.

The government has adjusted thousands of cases, and the statistical information obtained is invaluable. It may interest you to know that for all the non-metals produced in the United States consisting of about 150 different natural resources, the average depletion deduction amounts to a trifle less than 2 per cent of the gross income. That is, the cost value of the natural resource is about 2 per cent of the selling price. The average cost value of some of the natural resources follow:

	Per Ton
Limestone	1c
Gypsum	3c
Sand and gravel	1 to 1½c
Fireclay, for refractory brick	3 to 6c
Clay, for brick and tiling	½ to 2½c
Glass sand, the best grades, about	6c
Moulding sand	2 to 10c
	Cu. Ft.
Monumental stones, marble and granite for the finished or dressed product	3 to 5c

Such non-metals as magnesite, feldspar, fluorspar and sulphur, due to their scarcity, have greater values.

Salt has very little value in nature. Under the state of Michigan it has been estimated that there is enough salt to supply this country for 100,000,000 of years. One deposit was found to be 2400 ft. thick and of unknown area when the drilling stopped. (This last not in Michigan.) Contrary to the popular belief that the ocean is the source of all salt deposits, the converse is true, and the salt deposits furnish the salt for the ocean.

Exceptional Cases of High Valuations

Of course there are exceptions to all rules. One place where a smelter is operating it procures the limestone necessary for its flux from a distance of more than 100 miles. In this locality a small deposit of suitable limestone was discovered and it actually cost 25 cents per ton, but was soon exhausted. The statement has been made that limestone in this locality is worth 25 cents per ton in place. It is in fact, if a deposit could be found, it could be sold for 50 cents per ton in place, for even then it would be much cheaper than paying freight.

I have actually paid $6.40 per cu. yd. for suitable sand for concreting in one of the Western states. Needless to say, the sand producer received a very small part of that $6.40; most of it went for freight. I mention these facts to illustrate that the government does not apply one fixed value to all deposits. Most of the non-metals have small value in nature because where they do occur they are usually in large quantities.

Possible Standardization of Tax Rates

There is one plan by which I feel that Uncle Sam might eliminate, to a large extent, his "army of clerks" in collecting tax, and some day I hope it may be tried. It would not be difficult to compile, from the thousands of cases already adjusted, a proper rate of tax to be taken on the gross income for each line of business. For you members I think I could tell you, were I permitted, just what percentage of your gross income would be a fair tax, and this would represent the entire industry with all due allowances made for depreciation, depletion, taxes, etc., taken into consideration.

I can imagine with what gratitude you would greet such a statement. It would be an easy matter to adjust your prices at the beginning of the year and your troubles would be over so far as income tax is concerned; this would also save the government much money in keeping this "army" in Washington.

As many of you know, the closing paragraph for letters adopted by the department begins as follows: "As it is desirable to dispose of your case at an early date." Tradition has it that once a letter was mailed reading: "As it is desirable to dispose of your **cash** at an early date," etc. The impression seems to be that the government, as a veritable ogre, sits on its throne in Washington with outstretched hands ready to grasp the shekels from the unwary and overburdened taxpayer to satisfy its insatiable demand for money. The facts are, the war must be paid for, the income tax is an established reality and the levy must be impartially made upon all. The minions of the government, represented by this "army of clerks," are merely endeavoring to see that the laws are equitably adjudicated.

When all is said and done, the taxpayers constitute the government, and the "clerks" are representing you. As far as I know, not one employe has ever felt that it was incumbent upon him to resort to nefarious practices in determining tax liability. It is the desire of the government, and therefore its employes, to adjust the taxes fairly and honestly for all.

In closing I wish to express my appreciation for the co-operation extended at all times by your executives and members. Such an organization as the National Sand and Gravel Association presents one of the best media for a complete understanding between the taxpayers and the government that can be conceived. Taxpayers should realize that the government employes are servants of the people, and while taxpayers make mistakes, the employes do likewise, but all these are matters of adjustment.

I have endeavored to touch upon a few of the angles presented in this not particularly enjoyable occupation of collecting income tax, and I trust that my efforts, in some small way, may prove enlightening.

In thanking you for your kind attention throughout, and the courtesies extended me, I also wish to include Hon. D. H. Blair, Commissioner of Internal Revenue; Mr. E. H. Batson, former Deputy Commissioner; Col. E. W. Chatterton, Deputy Commissioner, and Mr. A. H. Fay, Head of the Natural Resources Division, whose acquiescence in this matter made possible the acceptance of your invitation to address the members of this association.

Slate Industry's Advertising Policy

Slate's Hundred Uses to Be Given Wide Publicity. Plans Embrace Wide Consumer and Trade Advertising

THE adoption of an advertising policy was perhaps the most far-reaching move made by the National Slate Association during the slate industry meetings at the Hotel Commodore, New York, on January 22 and 23.

This industry is among the oldest and most conservative of the country's industries and the unanimous acceptance of a co-operative advertising policy in the closing session of the convention marked the opening of a new epoch in the marketing of slate.

The slate market may be divided into five general divisions: roofing, structural and sanitary, electrical, educational and granules and slate powder. While use for roofing purposes still remains the largest single outlet for slate, there is a marked and increasing demand for structural and electrical slate.

While there are a hundred main uses for slate, new uses are constantly springing up, and it was because of the marketing ramifications of the industry that the National Slate Association was formed in June, 1922.

The primary purpose of the association is to establish a definite source and responsibility for slate information through a recognized organization and to stimulate the sale of slate products by bringing its properties and uses to the public consciousness.

Headquarters were opened last summer in the Drexel building, Philadelphia, under Warner S. Hays, secretary of the association. Results were so immediate and of such value to the industry that the membership, now representing about 80 per cent of all slate production in the United States, came to the first annual convention full of enthusiasm and eager to broaden its field of activity.

The sessions of the convention were given over to a discussion of such subjects as "Production Problems and the Elimination of Waste," "Trade Co-operation," "Scope of 1923 Activities" and "Traffic Matters."

"Some Unique Features of the Industry"

In his paper with this title Dr. Oliver Bowles declared that: "As an engineer in the Bureau of Mines my activities are not confined to slate, but include all branches of the stone trades as well as certain other of the non-metallic mineral industries. Such extensive work has the disadvantage of preventing one from becoming familiar with all the details of any one branch. On the other hand, it enables one to take a general perspective view of the industries, and to contrast them with each other.

For about two years I studied the slate industry in some detail from the inside, and lately I have attempted to interpret this inside knowledge in the light of experience gained in other fields. This has led me to view the slate industry in a somewhat critical frame of mind, and to balance its peculiarities, as well as its failings and its virtues, against those of similar industries. It is possible that some of the conclusions reached may not be exactly right, but in a gathering of this character they may at least constitute the nucleus for discussions that will uncover possible weaknesses in the industry, and suggest remedies therefor. One conclusion has a very direct bearing on this convention, for it relates to the research activities of trade associations.

Some commodities meet with little competition from outside sources. They possess properties that fit them peculiarly for certain definite purposes, and no other materials can successfully replace them. Industrial research through a trade association may be conducted in an industry that thus possesses a monopoly in a given field, but there is a tendency for it to lack the vigor that results from the incentive to keen competition on the outside.

Competition Demands Research

Slate is an industry of quite different type. There is scarcely a single use for which slate is employed that some other material may not be used in its stead. I do not say that substitute materials may be used with equal satisfaction, for most of them are inferior, but through active advertising and low prices they are used very widely in places where slate might otherwise be employed. Thus a condition exists where slate in the form of switchboards, blackboards, roofing or structural material fills only a small part of the industrial need, for it is crowded and jostled by neighbors who, for the most part, are friendly but aggressive. Thus it has come about that the chief competition is not between individual companies in the slate industry, but competition within the industry is quite over-shadowed by the great forces from outside.

Competition demands research in better production methods, improved equipment, and utilization of waste, so that a better product may be manufactured at lower cost. As a result of such research the industry is in a better position to cope with its competitors.

There is, however, another respect in which slate stands alone. Of all the stone industries there is none which can approach slate in the proportion of gross production thrown on the waste heap. In some stone industries, as for example in cement manufacture, practically every ton of the stone quarried is used. In the lime and fluxing industries screenings may be regarded as waste. In marble and granite quarrying the waste is high, but rarely does it approach that found at most slate quarries. This is a phase of the slate industry to which I have given considerable attention.

Waste Prevention

The problem of waste utilization which will be discussed at a later time is by no means hopeless, but it is difficult, and in view of the many difficulties encountered I wish to direct attention to the tremendous importance of that other branch of the problem, namely, waste prevention. I firmly believe that greater success in solving the waste problem will be attained in the field of waste prevention than that of utilization.

Prevention is indeed the most desirable solution, for it is better to utilize raw materials to the fullest possible extent for major products that to branch off into by-product industries where manufacturing and marketing problems are new and unfamiliar. Byproduct industries are no doubt important, and their development is greatly to be desired, but I contend that the quarryman's first and foremost question is, "How may I reduce waste to the lowest possible point?" and the second question is, "How may I use to best advantage the unavoidable waste?"

Possibilities in Waste Reduction

Now what are the possibilities in waste reduction? It has been accomplished in Maine by tunneling, but underground methods are not generally applicable. In general, I would state that in quarries where the least machinery is used the waste is greatest, other things being equal. In many quarries blasting is carried to excess. Here again the contrast of slate with other stone industries is instructive. In the great limestone quarries of Bedford, Ind., the sandstone quarries of Amherst, Ohio, and the marble quarries of Vermont, Georgia and Tennessee, explosives are rarely used except in stripping. Wall cuts are made by channeling while bottom-breaks and cross-breaks are made by wedging in drill holes.

I believe that slate is almost as easily shattered as marble or sandstone, and yet explosives are used in great quantities in many slate quarries. A marble man would regard explosives as destructive an agent in his quarry as a bull in a china shop. If channeling machines were more widely used in slate quarries in place of blasting, particularly for wall cuts, much good rock would be conserved.

Not only does blasting cause excessive waste by shattering, but the resulting blocks are so irregular in shape that much additional rock is lost during the process of manufacture. When carefully handled powder may be used for floor splits and breaks on the grain, but I see no reason for using explosives in wall cuts except that it has been done for many years, and quarrymen, like operators in other industries that have grown up without investigational work, are loath to make radical changes in method. The high percentage of waste is an outstanding feature with which you are all familiar, but the somewhat reckless use of explosives in slate quarries as compared with other types of dimension stone quarries, is a feature that demands emphasis and deserves serious consideration, for I believe it is one of the important features contributing to the excessive waste.

Structural Complexity

There is another respect in which slate is unique and that is, in the complexity of its structures. I use the term structures not in the architect's sense as applied to a house or office building, but as the geolo-

gist uses it in describing rocks. The geologist applies the term "structures" to the larger features of rock deposits such as the joints or cracks, the bedding planes, and the various cleavages, such as slaty cleavage or grain. The chief structures in marble, limestone and sandstone are bedding planes, joints, and a grain which is more or less indistinct or absent. Granite has joints, two directions of splitting known as rift and grain, but it has no bedding. Nature was not only generous but in a somewhat whimsical mood when slate was supplied with structures, for not only are all the major structures present but they are fitted together in a complex fashion.

Bedding is prominent, and slaty cleavage, the most important structure, is quite independent of bedding crossing it at any angle. Grain is also prominent, while joints and seams appear at various intervals and transverse the rock in different directions. These structures bear definite relation also to the finished product. A roofing slate, for example, must have its broad surface, parallel with the slaty cleavage and its long direction parallel with the grain. Thus slate is more complex in its structural relations than any other form of dimension stone.

Complexity of structure has a very definite bearing on this same problem of excessive waste. The structures themselves are unalterable qualities of the rock, but no phase of slate quarrying is more important than a proper understanding of the structures and an adequate method of controlling their effects.

The principle to be kept always in view is to quarry the rock so that it will be as free as possible from defects, and that as small an amount as possible of good rock will be attached to, or associated with, the undesirable structures. Consider, for example, the ribboned slate of Pennsylvania where the ribbon dips at a steep angle. If rectangular blocks are cut to include the ribbon, all the slate in the block will be ribboned stock; cut vertically between the ribbons, a very small block of clear slate is obtained, but if cut parallel and coincident with ribbons, the resulting block is clear stock of maximum size, and may be split into thin slabs with very little waste.

Such cuts may be made with certain types of channeling machines which will cut inclined channels readily up to an angle of 45 deg. Other methods of quarrying in accordance with rock structures are given in the Bureau of Mines bulletin[1] on slate which has recently appeared.

I have emphasized three respects in which slate is unique—its keen outside competition, its excessive waste and the complexities of its structures. There are various other ways in which it stands alone, but the three points mentioned are of exceptional importance and demand serious and constructive thought. I trust that this association will incorporate in its activities a program of aggressive work that will develop successful methods of meeting competition, of eliminating waste, and of nullifying the detrimental effects of complex rock structures.

An increased assessment for advertising was made on the membership on the basis of sales of slate quarried or manufactured by each active member. Advertising plans were laid out and accepted. These embraced wide consumer and trade advertising.

The slogan, "Slate—Consider Its Uses," was adopted in recognition of the advisability of stimulating wider general interest and of educating the public as to the many and varied uses of slate.

Through the contest conducted by the association, the best idea for a slogan was suggested by W. J. Reed, of Aurora, Ill., and the best insignia idea was received from Emery J. La Liberte, Brockton, Mass. They were unanimously awarded the prizes.

Another marked step in advance was the establishment of a traffic bureau to supply full information as to shipping and routing. G. E. Brown, of Belleville, Ill., was appointed traffic commissioner.

Appropriations for research work and special tests were also made. The convention closed its sessions with the adoption of a code of ethics to standardize general practice within the industry. This code is as follows:

Code of Ethics

ETHICS — The science of right conduct and character; the science which treats of the nature and grounds of moral obligations and of the rules which ought to determine in accordance with this obligation; the doctrine of man's duty in respect to himself and the rights of others.—Century Dictionary.

With the desire to place the slate industry on a high plane of integrity and efficiency, the members of the National Slate Association pledge their best efforts to see that the following principles govern and guide the business practices of the industry. All ethical rules may, in the final analysis, be comprehended within the statement of the Golden Rule, *"Do unto others as you would have others do unto you."*

1. To keep the welfare of the public first and foremost in the conduct of the slate business.

2. To produce and sell slate to give lasting satisfaction for the use intended and in accordance with standards adopted by the association.

3. So to conduct every business transaction that architects, builders, engineers, owners, and all parties will recognize and appreciate the superior service rendered them by the members of the association.

4. To accept the principle that the slate buyer is guided by the same motives as the seller, urging that all disputes be submitted to the board of directors of the association for the final satisfaction of the customer.

5. To welcome fair competition as an assurance of the largest opportunity for service to architects, builders, engineers, owners and all parties, making service and the adaptability of goods rather than price the basis of preference.

6. To train salesmen to be more than mere bid-filers or order-takers, and to recognize the vital principle of truth and personal service to owners and the public who will use the goods.

7. To urge architects and contractors to give full details and requests for slate bids and to carry on the code of ethics of the building industry adopted by the New York Building Congress.

8. To base all selling prices on the cost of production and selling, allowing only a legitimate profit as related to the investment in the business.

9. To be constantly on the alert to find better methods of production and distribution.

10. To follow sound ethical principles in the conduct of our business, and to put every transaction on the very highest plane of business honor.

11. Not to make false or disparaging statements respecting a competitor's product, his business, financial credit, etc., that would appear to the disadvantage of any slate, but at all time encourage the use of slate for purposes where it is unexcelled.

12. Not to harass competitors by fake requests for estimates on bills of goods, for catalogs, etc.

13. Not to sell goods at or below cost, as "leaders" coupled with statements misleading the public into the belief that they were sold at a profit by reason of the seller's superior facilities.

14. Not to use the samples or reputation of one manufacturer for the purpose of getting an order and filling it with similar goods made by another manufacturer.

15. Regardless of reported actions by competitors the facts should be ascertained before acting upon reports or inferences that would cast suspicion upon a fellow member.

16. Make no deductions, rebates, or discounts which would camouflage the contents or amount of a contract unless plainly stated on the face of the bid and invoice when shipment is made.

17. Any member of the association who influences the cancellation of a contract already taken in good faith by another member of the association and who profits by the cancellation shall be subjected to an investigation on the part of the board of directors if the party injured so desires, and findings of the board shall be final.

18. The members of this association are responsible for the merchandising methods for all acts or activities on the part of their salesmen in the field.

19. To discourage advertising of an unfair, misleading or demoralizing nature.

20. To aid every legitimate effort to elevate the standing of the slate business in the eyes of buyers and sellers, to uphold the prestige of the National Slate Association, and to make prompt report to the secretary of any established violation of this code of business practices and any subsequent additions thereto, whether by a member of the association or by another.

21. To foster and encourage craftsmanship among those who produce, apply or install slate. To co-operate with contractors and dealers who believe in and practice sound business methods, and advance the sale and proper use of slate.

The officers of the National Slate Association are president, W. H. Keenan, Bangor, Pa.; vice-president, G. F. Bernard, Boston, Mass.; treasurer, A. H. Morrow West Pawlet, Vt., and secretary, W. S. Hays, Philadelphia.

These three new directors were added to represent districts formerly unrepresented in the association: C. A. Lowry, Auld & Conger Co., Cleveland; C. H. Davis, Davis Slate and Mfg. Co., Chicago; P. C. Stanwood, Blue Ridge Slate Co., Esmont, Va.

The general offices in the Drexel building, Philadelphia, are in charge of Mr. Hays, who will direct the publicity and advertising. The advertising will be placed through Conklin Mann of New York.

[1]Bowles, Oliver, "The Technology of Slate," Bureau of Mines Bulletin 218, 1922. Copies may be obtained free of charge by sending a request to the Bureau of Mines.

"Selling" Architects and Engineers

Circular Letter Approval of a Building Materials Producer That Proved Highly Successful.

PRODUCING a building material like cement, lime, gypsum, sand, gravel or stone is only the first step in a successful business, as everyone knows. For however efficient your operation, the big problem, ordinarily, is to market the product. The following from *Printers' Ink* of December 28, 1922, may prove helpful to sales managers of rock products concerns in work with architects and engineers:

When a man sits down to write a piece of copy directed to the architect he is apt to think of him as a "professional man" first of all, and then as a human being. The discovery made by this company was that the architect is extremely human and will therefore react to friendly stuff and humor as well as any other class. "With an unusual product like ours," said Mr. Rittenberg of the Sumpter (S. C.) Brick Works, "I felt it was necessary to present it to the architects in an unusual manner in order to attract their attention. I took a copy of an architectural paper and selected the names of eight or ten architects who I felt were prominent, judging from their work, and mailed each a copy of my 'Waste-Basket Letter.' This letter was an unusual piece of work and started off, 'May the Good Lord save this letter from the waste-basket until you have read the first paragraph.'"

He then divided architects into four classes—real architects, regular architects, mediocres and two-by-fours. He told the latter two classes not to read any further in his letter; but the real architects and regular architects he went after with some jolly close-up hand-clasp copy. "In addressing this letter to you," he said, "I know just as much about you as you do about me, but if you are what we hope you are, you are going to know something of our unglazed glass brick. You never heard of such a thing before, have you? One man wrote us they reminded him of an Airedale dog, they were so darn ugly they were beautiful, and then sent us an order for a $100,000 residence. Please classify yourself by letting us know if you think you will be interested. We will send you samples to prove there is something new in brick and we have it."

Familiar Tone Was Appreciated

The nerve of a writer in asking an architect to classify himself after the start of his first paragraph would seem to be bad business, but the curious thing was that the architects seemed to like it. The results of this test letter were so general and satisfactory that the company proceeded at once to send the same letter out to architects in all leading cities where it had dealers. Some architects in answering the letter came back in the same tone. "You might send us a sample of the darn ugly brick so we can look it over again." Another one said, "The Good Lord has decreed that your letter should not go into the waste-basket. Such a letter as you have written should arrest the attention of anyone of reasonable judgment, and it could not have been written by anyone save a man with a great soul and an inner conviction and understanding of the brotherhood of man and the intricate duties of an architect." Another one said, "It is like a breath of fresh air on a sultry day to receive such a letter as yours of the 30th." Another said, "We fall before the subtle flattery of your letter on the 30th and find ourselves suddenly very interested in your brick."

The second letter talked about humor: "We believe that humor is one of the greatest gifts to man. Since we could not reach you through this sense, let us try another. Do you encourage originality and individuality in your drafting room—then why not among the manufacturers who furnish you material?" This, too, produced a goodly portion of replies.

The third letter sent out as a follow-up reminder started off, "To frown, you use sixty-four muscles but only thirteen to smile. Smile; it won't hurt you—much."

The fourth letter asked, "Why are architects like women?" and replied, "Because they are temperamental, artistic, erratic, faithful, fickle, have a good eye for color, and the longer you live with them the better you like them." This letter, which went on to compare bricks also to women, while it did not pull a great many replies, was talked about quite generally among the firms and individuals who received it.

In order to find out whether a continuation of the letters would be acceptable, a return postal card was placed in the last of the "architectural love letters," replies to which showed that architects were enjoying them immensely.

After the series of letters had been out for a few months, the president of the company made a trip to architects' offices in all parts of the East. In every office he entered the president found that the letters were more than an introduction; they were an open sesame. He says that from his experience he has come to the conclusion that architects are just as human as ordinary beings.

Canada's 1922 Outlook Good

THE outlook for 1923 is very promising among the rock products industries of Canada. The sale of cement during 1922 was greater than in 1921—in fact, was greater than had been anticipated. Residential building was carried on to a greater extent than any previous year and industrial building was somewhat better than in the previous year.

Unfortunately the demand for cement in 1922 occurred at the same time as the grain movement in the West was at its height. This led to a severe car shortage extending over several weeks' period.

The cost and efficiency of labor have shown a marked improvement with a year ago. Taxes, however, are increasingly heavy. From present indications practically all of the difficulties which beset the manufacturers in 1922 will be present to the same or greater extent in 1923.

It is believed, however, that the demand for cement in 1923 will show a slight improvement over 1922. The cement industry is quite an important one in Canada. This is an interesting statement when it is considered that previous to 1900 practically all the cement consumed was imported. In 1890 there were consumed 207,017 bbl. of which 93 per cent was imported. Ten years later there were used 663,942 bbl. of which 56 per cent were imported. In 1910 there were consumed 4,937,738 bbl. of which 7 per cent was imported. The peak was reached in 1913 when 8,913,014 bbl. were consumed. At the present time Canada is producing about 14,000,000 bbl. During the past year there were operating in Canada 18 plants, two in British Columbia, four in Alberta, one in Manitoba, eight in Ontario and three in Quebec. Several plants were idle.

During the past year the provincial government, federal government and municipal councils spent about $50,000,000 in the construction of highways in Canada. The government of Ontario spent $10,000,000 as their part of the program, while the sum spent by all the governments in Ontario, federal, provincial, county and township, was approximately $25,000,000. The work of the provincial government included 44.9 miles of bituminous asphalt, 43.26 concrete, 11.25 miles of bituminous macadam, 107.4 miles waterbound macadam, 487 miles graded, 1300 concrete culverts, and 23 bridges.

Since 1911 the Quebec government has spent $41,000,000 on roads. Out of 40,000 miles of roads there are 10,000 miles of main roads. An ambitious program has been laid out for 1923. This includes 550 miles of improved government roads and 325 miles by the municipalities. In New Brunswick 200 miles of highways were built and the same number of miles will, it is planned, be built in 1923. The Highway Board of Saskatchewan built 480 miles of highway. The amount spent in the province for road construction in 1922 by government and municipalities was about $4,500,000. In Nova Scotia 467 miles were built, 1300 miles improved, and 2000 miles are being maintained. At least 270 miles will be built in 1923.

There was also a big program carried out in the other provinces in 1922. In road construction there was necessarily a great consumption of cement, crushed rock, etc. It is anticipated that there will be a still larger program for 1923.

Limestone Rates Suspended

THE Interstate Commerce Commission has suspended until May 16 the operation of the schedule proposing the cancellation of the rule constructing combination rates on agricultural limestone in constructing through rates from Buffalo, Linwood and Davenport, Iowa, and Moline, Ill., to Illinois points and the application in lieu thereof of full combination of local rates. This will result in an increase in rates equivalent to the amount at present authorized to be deducted by the existing combination rule.

Charles Warner Sees Prosperity for Lime

ON a recent trip East the editor had the pleasure of an interview with Charles Warner, president of the Charles Warner

Charles Warner

Co., the American Lime and Stone Co., and of the National Lime Association. Mr. Warner cannot see it any other way than that the first half of 1923, at least, is going to be booming. Labor shortage is the only deterring factor.

The National Lime Association is making great strides in its research work. Three of the best college research laboratories in the country are each engaged in work along some special line, the chief object of which is to produce a more widely marketable building-lime product. Some work is also being done which will have an important bearing on lime-manufacturing methods. However, the main conception of the work ahead of the National Lime Association is that of sales promotion.

The research work now under way, Mr. Warner says, has practically assured the industry of a quick-setting lime plaster along at least two entirely independent lines. The last of the skeptics in the lime industry appear to be won over to the research program and ROCK PRODUCTS was not far off a few months back when it predicted revolutionary changes in the industry.

Some High Lights of the Sand and Gravel Convention

AS ROCK PRODUCTS for January 27 was going to press as the convention of the National Sand and Gravel Association closed its proceedings, it is pertinent that more of its high lights be given suitable mention in this the succeeding issue. For instance:

Mr. De Groot, of the I. C. C., urged that cars be loaded to full capacity as a means of avoiding shortage. That car shortage is being remedied by increased speed of repair of equipment in railroad shops. That only 9½ per cent of cars of this country are in the bad order class on January 1. That 21.1 per cent of locomotives are bad order (those requiring over 24 hr. for repairs). That on January 1, 1922, there were installed or on order 145,553 freight cars and that 77,221 were put into service in 1922 against 69,436 in 1921. That there are on order 2824 locomotives and that 1379 were put into service in 1922.

Shown by the Films

The government displayed a film showing the building of modern roads through 132,000,000 acres of forest preserve. Another showed typical modern methods in the handling of sand and gravel. Mr. Shiely's film showed the operation of his plant throughout, with cartooned insert showing Link-Belt and other mechanical features. The film was prepared by the educational bureau of his district (No. 19) to make the public familiar with the uses of sand and gravel and the need of good roads. Mr. Shiely said that the theaters were glad to show the films gratis. He also said: "It pays to advertise, but after you get the business, take care of it and keep it." This film cost $1500.

Mr. Cooper of the National House of Representatives said that war gave the United States a prominent position from which to deal with world affairs. "We have too much law and too much passing the buck to Congress. What do we need most? A genuine awakening as to what individuals should do and not to depend on Congress to bring conditions back to normal. He condemned the Railway Labor Board and explained his bill now before Congress to abolish it. Many of the railroads would have settled with their men but that the board was so farreaching that the railroads were not allowed to. Mr. Cooper declared that the board has completely destroyed all friendly relations between railroad employers and employes. The board costs the taxpayers $350,000 annually. Strikes should be settled by conciliation, mediation and arbitration.

Judge Nathan B. Williams, National Association of Manufacturers, said: "The feeling that the present system of taxation is unjust is common in all industries." Rules, regulations and restrictions are the three R's of the reformers.

"Associations make the members more powerful and enlightened and in general promote their welfare," said he. "They are necessary in order to take up legislative matters with proper authority. The power to tax is the power to destroy. Taxes are showing up the progress of this country."

Charles Biesanz, Biesanz Stone Co., Winona, Minn., brought up the question of new uses for sand. He accidentally discovered the use of sand as birdseed or grit, and is going to market it in competition with a grade now on the market retailing at 10 cents a pound. He has ordered containers and cartons for packing it and claims to have a justifiable market.

Mr. Dann said he has tried several methods of grinding small gravel into sand. He is designing a plant now for making sand.

Mr. Shiely inquired about making a ready mixed lime mortar. Mr. Carroll said that lime mortar cannot compete with gypsum mortar. Regardless of the kind and irrespective of whether it is mixed wet or dry, it has to be remixed and retempered at the job before using at least in the average Middle West and Eastern climates in winter.

Mr. Shiely urged that the National Association spread out in an educational campaign to teach users of sand and gravel to demand washed, screened and graded materials.

Some Activities Urged for the New Year

Take out membership in the association.
Be prepared to combat priorities.
Take up the question of "Kelly's 228."
Encourage publicity.

Hints and Helps for Superintendents

This Generator Is Driven from Any Direction

THE Massaponax Sand and Gravel Co., Massaponax, Va., has in service an electrical welding outfit mounted on a home-made boxcar that can be taken to any part of the operation by a quarry locomotive. When not needed at the plant or at the digging operation, the car is kept in the machine shop where it is most needed.

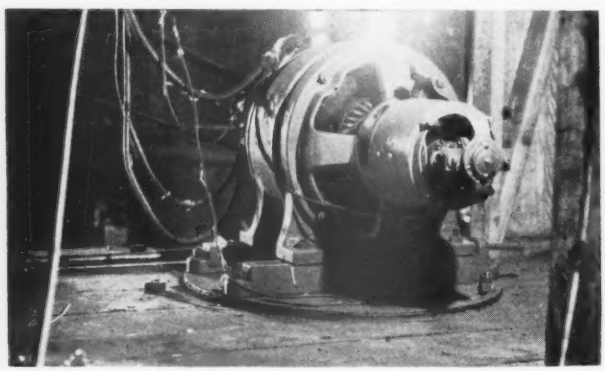
Electricity for welding is generated by a 10-hp. motor generator, belt-driven by a 10-hp. International gasoline-kerosene engine. The generator is mounted at one end of the car and the engine at the other.

The car is an exact miniature of a standard railroad boxcar, with the exception that one end is provided with a hinged door, opening the full height.

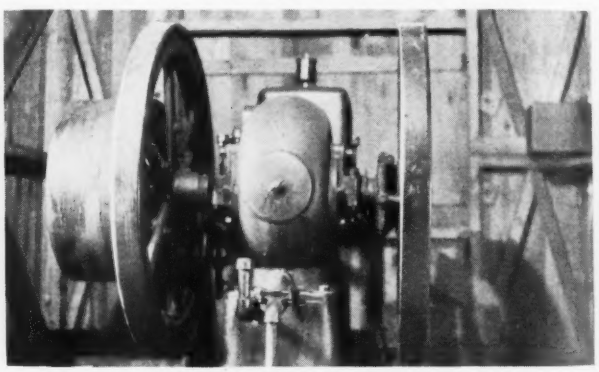
When the car is in the shop the door is opened and, by removing one bolt from the base, the generator can be turned one-quarter turn and connected by belt to a line shaft of the shop. It is preferable to drive the generator by the power from the shop because it is much less expensive than the engine drive.

In the illustration showing the generator, the door at the end of the car is open and the generator is being driven from the shop line shaft. Should the outfit be needed outside, all that is necessary to do to connect the generator with the engine is to remove the bolt at the extreme right, and then turn the motor one-quarter of a turn; it is then in line with the pulley of the engine.

The turntable base is made of two circular sheets of ⅜-in. steel plate, the diameters of which are the same, and equivalent to the largest horizontal diameter of the motor at its base. The plates are placed one on top of the other, the bottom one being bolted to the floor with countersunk bolts. The top sheet is secured to the generator base by four bolts which are also countersunk so that the plates are flat against each other. To facilitate revolving, a large bolt extends through the middle of the generator base, both plates and the floor. The one bolt through the plates (at the right) prevents the table from revolving when in use.



By removing one bolt from the base the generator can be turned around so that it can be connected easily to one or more drives



This engine, mounted at the opposite end of the car from the generator, drives the generator when the car is not in the shop

Preventing Conveyor Spillage

ON the ground under the average conveyor one can usually find evidence of the conveyor having lost part of its load, sometimes caused by spasmodic overloading and sometimes by a jerk or irregular speed of the drive. Usually, the spillage or waste is very small, but on conveyors where the load is variable, it is in most cases a considerable waste, necessitating the employing of a man with a wheelbarrow to clean it up.

At the plant of the Liberty Lime and Stone Co., Rocky Point, Va., a method is employed for preventing a spillage which is, while not unique, an unusual way of avoiding it. In the accompanying illustration the black spots in the center represent stones on a 24-in. conveyor belt (which is practically empty). On either side of the conveyor 2-in. planks are placed on edge approximately 3 in. from the edge of the belt, and to these planks strips of otherwise useless 6-in. belt are nailed so that the under-

Preventing spillage of material from conveyors suggests another use for worn-out belts

edges are on the conveyor. In this way there is no posible way for material to fall off before it gets to the end.

How to Simplify Timekeeping

THERE are few paymasters and timekeepers who have not experienced having men claim their envelopes to be short on payday. In many instances envelopes are short through the fault of the timekeeper or foreman, having "missed" a man when checking up the time. Shortages are also caused by the foreman's failure to report the men's overtime to the timekeeper.

Recently a ROCK PRODUCTS editor sat in the paymaster's office of the Massaponnax Sand and Gravel Co., near Fredericksburg, Va., while the men were being paid their weekly wages. He was surprised to observe that not one of approximately 50 men claimed a shortage. Upon inquiry, the paymaster handed him a small yellow card, explaining that it is the preventative for the lack of shortages.

One of these cards, illustrated herewith, is given to each man at the beginning of a new pay period, and it is his duty to have the foreman of his department punch the card indicating the number of hours he works each day. Thus, on payday each man has a receipt for the number of hours he has worked during the past period and knows beforehand how much money he is to receive.

When he receives his envelope he surrenders the card which then serves as the company's receipt.

In addition to a check on the hours the men work, the card also serves as a meal ticket at the company's restaurant, and thus eliminates all possibilities of a mistake or misunderstanding on the party of either party.

This card, of course, does not constitute the entire timekeeping system, as it is nothing more than a record for the individual employe. But it supplements the main system and affords the company a positive double check of its payroll.

MASSAPONAX SAND & GRAVEL CO

Week Ending _____ *Rate* _____

Name _____ *No.* _____

													MEALS	
Thur.	1	2	3	4	5	6	7	8	9	10	½			
	1	2	3	4	5	6	7	8	9	10	11	12		
Fri.	1	2	3	4	5	6	7	8	9	10	½			
	1	2	3	4	5	6	7	8	9	10	11	12		
Sat.	1	2	3	4	5	6	7	8	9	10	½			
	1	2	3	4	5	6	7	8	9	10	11	12		
Mon.	1	2	3	4	5	6	7	8	9	10	½			
	1	2	3	4	5	6	7	8	9	10	11	12		
Tues.	1	2	3	4	5	6	7	8	9	10	½			
	1	2	3	4	5	6	7	8	9	10	11	12		
Wed.	1	2	3	4	5	6	7	8	9	10	½			
	1	2	3	4	5	6	7	8	9	10	11	12		

(OVER)

Each man carries a card like this and has it punched daily by his foreman

Present Card for Your Pay

Workmen will only receive pay for time shown by punch-mark on this card.

See that card is punched correctly each day, as no claim for error in time allowed if card agrees with payroll

All cards must be in office WEDNESDAY, *by six o'clock*, or time will have to go on the following week.

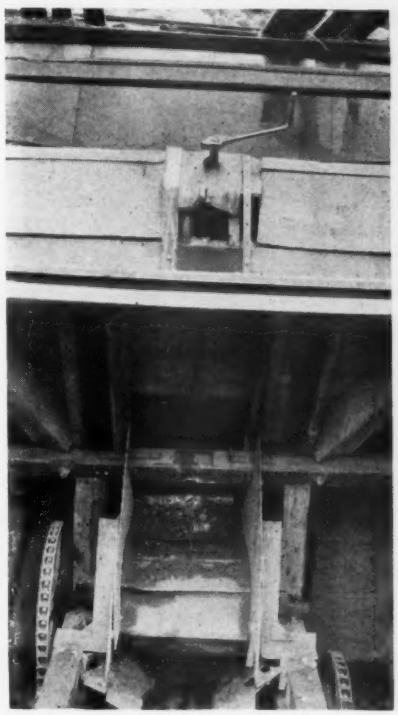
Transfer of card not honored

Present card in dining-room to have punched for meals.

This side of the card explains its use to the men

An Adjustable Hopper Gate

THE hopper shown in the illustration receives sand and gravel from 40-yd. cars, so that it is practically filled every time a car is dumped. This, of course, makes necessary a type of gate that can be regulated according to the amount of material in the hopper, for, should the gate be wide open when a car is dumped, the conveyor leading from the hopper would be overloaded, resulting in spillage and waste.



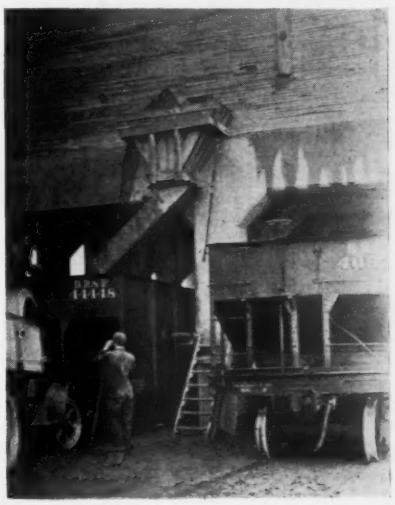
By operating the crank the gate is opened or closed as desired

As shown in the illustration, the gate on this hopper is controlled by a crank at the upper end, which is within reach of the attendant on top of the hopper. The gate itself is of ½-in. steel plate and is provided with a tapped hole in which a screw, operated by the crank, works. Thus, to open or close the gate, the crank is turned to the left or right as desired.

This method is a safer and surer way of apportioning the feed to the conveyor and is more simply operated than the usual lever type. It is in use at the plant of the Massaponax Sand and Gravel Co., Massaponax, Va.

Mixing Sizes Easily

THERE are many devices for getting mixtures of different sizes of stone or gravel in varying proportions. Some are better suited to certain conditions than others, and every new way is of interest.



Mixed sizes are as easy to load as single sizes with this arrangement of gates and spout

At the Le Roy Lime and Stone Co. plant, Le Roy, N. Y., adjacent bins have, in the lower adjacent corners, gates which discharge into a common hopper and chute. Directly under each row of bins are loading tracks, and gates in the bottom of these bins will load a single size of stone into cars. When a mixture of two sizes is desired, the swivel spout attached to the small hopper at the end of the bins is swung about to discharge in the car, the two end gates referred to are opened to give the desired proportions in the mix, and the car is loaded with materials well mixed as they drop into the car. Trucks can be loaded with mixed sizes in the same way.

Traffic and Transportation

By EDWIN BROOKER
Munsey Building, Washington, D. C.

The Combination Rule

A MATTER of universal interest to the construction industry is the proposal of the carriers to withdraw the combination rule now published in Kelly's Tariff No. 28 and which proposal means an increase of 30 cents per ton on shipments now moving under a combination of local rates, unless the producers of sand, gravel, and crushed stone take action to protect their interests.

The railroads have announced their intention to cancel this rule. When, we cannot say. They have offered to publish through rates upon request of producers in cases where a substantial movement can be shown, and if producers fail to make these requests upon the railroads it will place them in an embarrassing situation if later they find this rule has been cancelled and their rates have been increased as contemplated by this proposal of the roads.

This subject was discussed fully at the convention of the National Sand and Gravel Association, which made this a live subject and is doing all that is possible to protect the interests of its members in this matter. The following is an excerpt from its Bulletin Supplement No. 34 issued February 1:

In Bulletin Supplement No. 30 of December 28 and Bulletin Supplement No. 31 of January 4, emphasis was laid on the primary importance of action by members in taking steps to protect their interests, due to the proposal of the carriers to cancel the "combination rule" now published in Kelly's Tariff No. 228. As previously indicated, widespread interest was displayed in the matter at the convention last week and the necessity of immediate action was clearly shown.

The National Association has suggested a definite and concrete plan to the various railroad associations, which, if adopted and placed into effect by all carriers, will fully protect the interests of all members. Applications have been filed with the different railroad associations, seeking their approval of a proposition to publish a rule in each tariff naming rates on sand, gravel and crushed stone, providing for proportional rates to and from all junction points with connection railroads, on a basis of 15 cents per ton less than the local rates to and from such junction, the proportional rates to apply only on such shipments receiving a road-haul movement in and out of the junction points to which reference is made.

The combination of such proportional rates will result in a continuance of the same through rates which are now made by use of the combination rule and will do away with the necessity of the publication by the railroads of a mass of through rates.

There may be a strong objection on the part of some carriers to this method of taking care of the situation, inasmuch as they are now committed to the policy of the publication of through rates to points, only where a substantial movement can be shown. This latter method of handling the matter is not satisfactory to sand, gravel and crushed stone producers, as it will not protect them on future shipments to points to which a substantial movement cannot be shown at this time.

The success of the National Association in this matter depends to a large extent on having the members secure the support of the railroads serving their plant to this proposal, which contemplates a system of proportional rates to and from junction points. Each producer now shipping to any territory where the through rates are made on a combination basis should request the railroads serving his plant to publish through rates so as to continue in effect present rates made on a basis of the combination rule and, at the same time, call attention to the applications which have been filed by the National Association and which will fully take care of each individual situation of members if placed into effect by the railroads. It is necessary that members make this individual request on the railroads in order that they will be protected in case the railroads decline to establish the general basis which the National Association has suggested.

As a closing enjoiner: take action immediately to prevent an increase of 30 cents per ton on shipments moving on a combination of local rates.

The Interstate Commerce Commission will not listen to future protests of shippers if this increase takes place, unless the producers come before them with clean hands and can show they have made a request on the railroads to establish some basis which will continue the present rates made on the basis of Kelly's Combination Rule.

***ATTENTION** of the producers of sand, gravel and crushed stone is directed to the attempt of Southern railroads to revise present commodity rates to the mileage-scale basis. Dockets Nos. 8714, 8723 and 8769 of the Southern Freight Association are illustrations of the general movement which has been going on for some time whereby the rates are being increased.*

Shippers should be placed on their guard as there have been numerous propositions going through the past few months in which rates are being advanced from a commodity basis to the mileage-scale basis. It is a part of a general movement going on in Southern territory since 1921 to establish a uniform mileage scale on sand, gravel and crushed stone.

All shippers of sand, gravel, and crushed stone should heed the warning issued by the National Sand and Gravel Association outlined above and take immediate action to protect their interests.

(Any shippers who are not members of the National Sand and Gravel Association who desire assistance in this matter can secure the same by taking this matter up direct with Edwin Brooker, 203 Munsey building, Washington, D. C.—EDITOR.)

Proposed Changes in Rates

Central Freight Association

5883. Furnace Slag, Ashes and Cinders from Mingo Junction and Steubenville, Ohio, to Jane Lew and Weston, W. Va., present, 25 cents, proposed, $1.50 per net ton.

5884. Crushed Stone and Stone Screenings, from Bellevue, Ohio, to Bergholz, Ohio, $1.40; Dillonvale, Ohio, $1.40; to Minerva, Ohio, $1.10 per net ton.

5894. Lime, from Huntington, Ind., to Greenfield, Ind., present, 14 cents, proposed, 12½ cents per 100 lb.

5896. Crushed Stone, from Kankakee, West Kankakee, Lehigh and Van's Siding, Ill., to the following points:

To	Present	Proposed
San Pierre, Ind.	$0.88	$0.86
Rye, Ind.	1.00	.86
Hamlet, Ind.	1.00	.86
Walkerton, Ind.	1.01	.86
Ginger Hill, Ind.	1.01	.95
S. S. & S. Jct., Ind.	1.01	.95
Olivers, Ind.	1.01	.95
Millers, Ind.	.88	.86
Porter, Ind.	.92	.86
Burdick, Ind.	.92	.86
Durham, Ind.	.95	.86
Rolling Prairie, Ind.	1.00	.95
New Carlisle, Ind.	1.00	.95
Lydick, Ind.	1.01	.95
Dillon, Ind.	.95	.86
La Porte, Ind.	.95	.86
Michigan City, Ind.	.95	.86
Niles, Mich.	1.01	.95
Buchanan, Mich.	1.01	.95
New Buffalo, Mich.	1.00	.95
Rugby, Ind.	1.01	.95
Bertrand, Mich.	1.01	.95
Webster, Ind.	1.01	.95

5906. Gravel, from St. Louis, Mo., to Harrisburg, Pa., present, 52½ cents, proposed, 33½ cents per 100 lb.

5938. Quarry Waste (Stone), from Marblehead, Ohio, to Bay Bridge, Ohio, present, 50 cents, proposed, 40 cents per net ton.

5941. Sand and Gravel, from Marion to Lima, Ohio, present, 80 cents, proposed, 70 cents per net ton.

Illinois Freight Association

1649. Sand and Gravel, minimum weight 90 per cent of marked capacity of the car, from Steele, Ill., to Joliet, Ill., 30 cents per net ton.

1658. Crushed Stone, minimum weight capacity of the car, from Lehigh and Kankakee, Ill., to Riverton, Dawson and Buffalo, Ill., 88 cents per net ton; from Thornton, Ill., to Riverton, Dawson and Buffalo, Ill., $1.01 per net ton.

Southern Freight Association

8708. Sand and Gravel, minimum weight, 60,000 lb., from Norris, Ga., to Cordele, $1.80; Moultrie, $1.69; Quitman and Thomasville, $1.35; Tifton, $1.13; Valdosta, Ga., $1.24 per net ton. Rates proposed represent reductions.

8712. Cement, from Rockmart, Ga., to Dravo Spur and Burchfield, Ala., present 11½ cents, proposed, 16 cents per 100 lb. Proposed rate same as at present published to Tuscaloosa, Ala., and will place these rates on Fourth Section basis.

8713. Cement, from Birmingham and North Birmingham, Ala., to stations on the Yadkin R. R., present 21½ cents, proposed, 26 cents per 100 lb. Proposed rate is the same as at present in effect from Leeds and Ragland, Ala., and Richard City, Tenn.

8714. Crushed Stone and Stone Screenings. Proposed to advance rates from Tyrone, Ky., to Lexington, Shelbyville and Versailles, Ky., and from Tucker, Ky., to Lexington, Louisville and Shelbyville, Ky., to be on the one line scale as published in Southern Ry., I. C. C. No. A9490A; rates to intermediate points to be revised where necessary; proposed to advance rate from High Bridge, Ky., to Lexington, Ky., from 50 cents to 63 cents per net ton; to cancel rate from High Bridge, Ky., to Louisville, Ky., account of no movement; to advance rate from Tyrone, Ky., to Louisville, Ky., from 68 cents to 80 cents per net ton so as to be more in line with Southern Ry. mileage scale.

8723. Sand and Gravel, from Garysburg, N. C. to Richmond Division Stations and Lewiston Branch Stations of the Portsmouth Division of the Seaboard Air Line Ry. Present rates as published in Agent Cottrell's I. C. C. No. 400 and S. A. L. I. C. C. A-6620. Proposed to establish rates on basis of the mileage scale submitted by the carriers to the Georgia Commission for application within that state, except in some cases this basis is departed from in order to avoid Fourth Section violations.

8737. Cement, from Fordwick, Va., to C. & W. C. stations. Proposed to reduce the present rates between Beaufort, S. C. and Savannah, Ga., so as not to exceed the Beaufort combination.

8748. Crushed Stone, from Blankenbakers, Ky., to Louisville, Ky., present 56 cents, proposed 63 cents per net ton. From Viley, Ky., to Lexington, Ky., present rate, $6.75 per car, plus 1 cent per 100 lb. at actual weight, proposed 70 cents per net ton. Proposed rates are made in relation to rates from and to equidistant points on the L. & N. R. R.

8769. Sand and Gravel, from Charleston & Western Carolina Ry., pits and Augusta, Ga., to Southeastern and Carolina points. Proposed to revise present rates as published in Agent Glenn's I. C. C. A282 from Augusta, Ga., and C. & W. C. Ry. I. C. C. No. A778 from C. & W. C. pits, to the following basis: from C. & W. C. pits and Augusta, Ga., to South Carolina points, on basis of the mileage rates prescribed by South Carolina Railroad Commission; to points in Georgia and Florida, to which commodity rates are now published from C. & W. C. South Carolina pits, to apply the lowest available mileage to the scale of rates proposed by the carriers to Georgia Railroad Commission in June, 1921.

8807. Cement, from Leeds, Ala., to Marietta, Ga., proposed rate, 11½ cents per 100 lb., same as in effect from Ragland, Ala., to Marietta, Ga., and also the same as from Leeds, Ala., to Cartersville, Ga.

8808. Cement, from Leeds and Ragland, Ala., to Montezuma and Oglethorpe, Ga., 16 cents per 100 lb., which is the same rate as in effect from Birmingham, Ala.

8815. Slag, from Alabama points named below and Chattanooga, Tenn., to Macon and Americus, Ga. Present rates: from Birmingham and group, Anniston, Alabama City, Attalla, Gadsden, Ala., and Chattanooga, Tenn., to Macon, Ga., $1.24; from Trussville, Ala., to Macon, Ga., $1.33; from Attalla and Gadsden, Ala., to Americus, $1.58; from Trussville, Ala., to Americus, Ga., $1.67 per net ton. Proposed to establish rate of $1.53 per net ton from Birmingham and group, Anniston, Alabama City, Attalla, Gadsden, Ala., and Chattanooga, Tenn., to Macon, Ga., and from Attalla and Gadsden to Americus, Ga. Proposed rate is same as now in effect from Birmingham, Anniston and Alabama City to Americus. Proposed to establish rates from Trussville, Ala., to Macon and Americus, Ga., 9 cents per net ton higher than from Birmingham, Ala.

8819. Lime, minimum weight 40,000 lb., from Fort Payne, Ala., to Lexington, Ky. Present, $3.83; proposed, $2.59 per net ton.

8826. Crushed Stone, from Dolcito, Ala., to Memphis, Tenn., $1.35 per net ton, the same as from Birmingham, Ala.

8831. Cement, from Leeds, Ala., to Y. & M. V. stations, Woodville district. Present rate, 19 cents per 100 lb. Proposed rates: to stations, Rains, Richardson, Jackson Spur and Brothers, La., 20 cents; to Laurel Hill, La., Turn Bull, Ashwood and Woodville, Miss., 20½ cents per 100 lb. Proposed rates are the same as in effect from Birmingham and Ragland, Ala.

8840. Slag, from Birmingham, Ala., and group, Anniston and Alabama City, Ala., to A. C. L. R. R. stations in Florida. No through rates are in effect and lowest combination applies. Proposed rates to Brisson, Beardall, Moore's Cameron City, Palm Villa, Sipes, Beck, Hammock, Stevens, Crippen and Mecca, Fla., $3.27 per net ton. Proposed rate is on basis used in establishing rates to other points south of Jacksonville, Fla.

Southwestern Freight Bureau

7457. Cement. To establish rates based on 2½ cents per 100 lb., higher than rates published from St. Louis, Mo., on pages 23 and 24 of Sup. 9 to S. W. L. Tariff 90D from Hannibal, Mo., to points in Louisiana on the N. I. & N. R. R. It is claimed proposed rates will place Hannibal, Mo., on the proper basis as compared with St. Louis, Mo.

7461. Sand and Gravel, from Denham Springs, La., to Beaumont, Texas, 9 cents per 100 lb., to Orange, Texas, 8½ cents and to Port Arthur, Texas, 10 cents per 100 lb. Proposed rates are based on Shreveport-Texas scale, using short line mileage, which, it is claimed, is same basis on which other rates from Louisiana points are made.

New England Freight Association

4174. Sand. N. O. S. minimum weight, 90 per cent of marked capacity of car, from Provincetown, Mass., to Springfield, Mass., 12½ cents per 100 lb., to apply as a proportional rate on shipments to points on the B. & A., to which no through rates are in effect via Springfield. Proposed rate is necessary to enable shippers to compete in markets on the B. & A.

Trunk Line Association

11006. Building Lime, minimum weight 30,000 lb., from Bellefonte, Pa., to Petrolia, Pa., 16 cents per 100 lb.

11009. Sand and Gravel, minimum weight 90 per cent of marked capacity of car, from Avoca, Pa., to Forest City, Pa., 6½ cents per 100 lb.

11016. Cement, from Egypt, Lesley, Ormrod, Saylor and West Copley, Pa., to New England territory, rates on the same basis as in effect from Chapman and Evansville, Pa.

11027. Cement, from Union Bridge, Md., to Louisa and Trevilian, Va., 19 cents per 100 lb.

Western Trunk Line Committee

2933. Keene's Cement, from Medicine Lodge, Kan., to Blue Rapids, Kan., present, 18½ cents; proposed, 14 cents per 100 lb.

2950. Sand and Gravel, from sandpit adjacent to Clay Center, Kan., on to Clay Center, Kan., present, 3½ cents per 100 lb.; proposed, $9 per car.

2957. Sand and Gravel, from Muscatine, Ia., to Omaha, Neb., present, 17 cents; proposed, 11 cents per 100 lb.

Ohio Macadam Association Discusses Tax Laws

THE Ohio Macadam Association held its annual meeting in Columbus, Ohio, on January 30 and 31. The principal topic of discussion was the proposed changes in the state tax laws which will have a large effect on the funds available for road building and maintenance.

Edward E. Evans

Perhaps never before was the need of such an association more clearly demonstrated, for through its activities much knowledge has been gained of legislative proposals that otherwise would undoubtedly escaped the attention of producers; and certainly the prime requisite in the matter of forecasting one's production is knowing what money is to be spent for highway work and where it's coming from.

The prospects seem to be that the economy plans of Ohio farmers will result in limiting the tax rate to such an extent that road work based on tax levies and on state and county bond issues will be materially handicapped. On the other hand, there are several bills before the legislature to levy a tax on gasoline, which would, in a measure, supply money for such road work. It seemed to be the consensus of the members of the Ohio Macadam Association that a gasoline tax was a fair and equitable method of raising money to continue road work.

The sentiment against the higher cost pavements seems to have pretty well crystallized in Ohio during the last year; the new governor was elected partly on a promise to build cheaper roads. That and the fact that additional emphasis is being placed on road maintenance, gives the crushed stone industry of Ohio as bright an outlook for the current year as it has ever had—providing only that a method of raising money is provided.

In this connection the monthly bulletin of the association—*Macadam Service*—has unquestionably been an important factor, and the association expressed its recognition of this fact by voting to increase its circulation to 10,000 copies per month.

This year the banquet of the association was a real family affair. Everyone there had an opportunity to express his sentiments and his ideas; and it developed quite largely into a reminiscence meeting. Allen Patterson and A. Acton Hall, pioneers and past-presidents of the association and its predecessor, the Ohio Stone Club, told many interesting stories of the early struggles of the stone industry for recognition. Today, as Secretary Sandles pointed out, it has a very influential organization and has been a large factor in molding public opinion in the state.

The following officers were elected: President, E. E. Evans, Whitehouse Stone Co., Toledo; first vice-president, T. Carl Jansen, Bluffton-Lewisburg Stone Co., Lima; second vice-president, G. H. Faist, Woodville Lime Products Co., Toledo; treasurer, W. J. Keever, Marble Cliff Quarries Co., Columbus; secretary, A. P. Sandles, Columbus; assistant secretary, Claude L. Clark; executive committee, W. J. Keever, chairman, A. A. Hall, E. E. Evans, T. Carl Jansen, W. D. Robison. Board of Directors: E. E. Evans, Whitehouse Stone Co., Toledo; J. H. Pogue, Hancock Stone Co., Findlay; B. T. Van Camp, Van Camp Stone Co., Cincinnati; E. W. McCall, Tarbox & McCall, Findlay; J. A. Moore, Higgins Stone Co., Bellevue; G. H. Faist, Woodville Lime Products Co., Toledo; L. A. Beeghly, Standard Slag Co., Youngstown; T. Carl Jansen, Bluffton-Lewisburg Stone Co., Lima; A. A. Hall, Ohio Marble Co., Piqua; E. M. Lamkin, Kelley Island Lime and Transport Co., Cleveland; O. A. Brand, Barrett Co., Cleveland; W. J. Keever, Marble Cliff Quarries Co., Columbus; W. D. Robison, Toledo Stone and Glass Sand Co., Toledo.

Questions and Answers

Edmund Shaw, Consulting Engineer, Chicago, Ill., Expert on Problems of Screening, Washing and Hydraulic Separation
THE TECHNICAL STAFF OF ROCK PRODUCTS
Edwin Brooker, Washington, D. C., Consulting Expert on Matters of Transportation and Freight Rates
Gordon Smith, First National Bank Bldg., Chicago, Ill., Expert on Crushing and Storage Problems

No. 26. **Drifting Sand.**—How may sand be prevented from blowing away from stockpiles and drifting with the wind?—S. Co., Leith, Eng.

A.—Piles of "tailings," the crushed ore from which the greater part of the metallic value has been extracted, are sometimes saved at mines, and to prevent loss by the blowing away of the dried sand, they are wet down occasionally with a hose. A spraying nozzle must be used to prevent the sand from washing away.

The drifting of sand by the wind may be prevented to some extent by the use of fences, like the snow fences which keep the snow from railroad tracks. These fences create an eddy current which causes the sand to drop. This method is used by some railroads in the Southwest (in Arizona and New Mexico, especially) to prevent the sand that is carried by the wind from covering the tracks.—E. S.

No. 27. **Placing Crusher on Tops of Bins.**—Is it considered good practice to install a crushing plant on top of the bins which are to hold the crushed material?—M. C.

A.—Small crushers have been placed on top of bins for as long as bins and crushers have been used, and it is probable that a certain number of them will always be installed in this way. But it is not considered good practice, as the vibration affects both the bins and the crusher.

In the best plants the crusher is placed solidly on the ground and the material spouted to it from the screen. The crushed rock is fed into an elevator which takes it to the screen for the rejection of the oversize which is spouted back to the crusher. A belt conveyor is often used instead of an elevator. A search through the back numbers of Rock Products will show many examples of this arrangement. —E. S.

No. 28. **Clearing Waste Water.**—We use water pumped from a well which was drilled and an 8-in. casing put down to wash sand and gravel. If we run the waste water from the screens into a large pond about 100 ft. sq. and about 6 ft. deep, could we put an overflow pipe at the surface of the water and run it back in the well? Would the water be filtered enough to re-use?

A.—Silt ponds, or mud ponds, are very commonly used to clear the waste water from washing plants in the way that you propose doing. Your question does not state the amount of water to be cleared, so it is not possible to say whether or not a pond of the size that you mention is large enough to do the work. The writer knows of one pond that is about the size of the pond you propose using that is handling 800 gal. per minute, and returning it clear enough for reuse.

It is a matter of the area of the pond and also of the settling rate of the clay, for some clays settle much faster than others. The water has also something to do with the settling rate. If there is a little lime in the water, for example, the settling rate is very much increased.

For this reason it is impossible to say that a pond will be large enough to settle a certain amount, without making tests on the settling rate of the clay in the water that is used in the plant. But ponds with 15 sq. ft. of area for each gallon per minute to be handled are usually large enough to clear the water.

A good way to determine the matter would be to make some experiments with a tub, noting how much clear water you can draw off after the muddy water has been standing for different lengths of time. —E. S.

No. 29. **Ideal Concrete Sand.**—Is there any such thing as an ideal concrete sand? By this I mean a sand which has just the right sizes of grains and just the right proportion of each size.—J. P. F.

A.—Standard Ottawa sand is used for comparison because it can be obtained at just the same quality all the time. But many sands will make a stronger concrete. If the ideal sand has ever been defined, the definition has not been widely published. All that can be said about it is that the best concrete sands have a low percentage of voids and a high coefficient of fineness.—E. S.

No. 30. **The Tyler Standard Screen System.**—I have seen references in some of your articles to the Tyler Standard screen system. Would you please explain what this is and how it differs from the ordinary system?—F. J.

A.—The Tyler Standard begins with a 200-mesh screen, which is .074 millimeter square (about .0029 in.) Each screen above this has just twice the area of mesh opening of the screen below it, so the side of the mesh is 1.414 times as long as the mesh below it, this figure being the square root of 2. As we are used to defining meshes by the number to the inch, the screens of this series are called by the nearest number of meshes to the inch. Beginning with the 200-mesh screen, they run 200, 150, 100, 65, 48, 35, 28, and 20 meshes to the inch, and so on. The numbers seem a little awkward to one who is just beginning to use the system, but one soon becomes accustomed to it.

The ordinary screens, 10, 20, 30, and 40 mesh and so on, are not directly related to one another in the sense that the size of one screen bears a definite proportion to all the other screens of the series. The advantages of the Tyler Standard system are evident when one uses it to plot screen sizes and to figure the modulus of fineness and in similar work.

The W. S. Tyler Co., Cleveland, Ohio, publishes a little book on screen testing which gives full information on the system and its use.—E. S.

No. 31. **Inclined or Vertical Elevator?** —Is an inclined elevator any better than a vertical elevator? Which gives the best service, a bucket and belt elevator or a chain elevator?—F. D. S.

A.—Vertical and inclined elevators do equally good work if they are properly designed and erected. There is sometimes an advantage in using an inclined elevator in that it carries the material a short distance horizontally at the same time that it elevates it, making it deliver the product farther toward the center of a bin, or something of that kind.

Bucket and belt and chain elevators do equally good work so far as elevating is concerned. The choice is a matter of the conditions under which the elevator will operate. Under some conditions, a belt will wear very rapidly.—E. S.

No. 32. **Lining for Sand Troughs.**—The troughs which carry the sand in our plant wear very rapidly. Would it be a good idea to line them with sheet iron or steel? —H. B.

A.—Such linings are often used, and No. 10 gage has been found satisfactory. A few holes may be punched at the edges so that it may be nailed in place. Usually it is not necessary to line the sides of the trough for more than a few inches, depending on the depth of the water.

In troughs which meet with severe service, so that the sheet-steel lining wears out rapidly, cast-iron liners made from chilled iron may be used.

There is a method which avoids the use of other lining than that furnished by the material which is being conveyed by the stream. This method is to put strips across the bottom to form little pockets in which the material will catch and cover the bottom of the trough. The trough must be given more grade, where this method is used.—E. S.

Accident Prevention

The Blaster's School as an Aid to Safe Quarry Operation—II

By Dr. E. M. Parlett
Supervisor, Safety and Health, Pittsburgh Limestone Co., New Castle, Pa.

THEREFORE, the operator should, in all fairness to himself and his co-workers, have a thorough and practical knowledge of the construction and operation of a battery, the testing of the battery and circuit with rheostat and galvanometer, efficient and correct methods of loading and tamping holes, the size, length and the proper manner of making the connections of lead and cap wires, the avoidance of short circuiting.

For textbook, the "Blasters' Hand Book," issued by one manufacturer, has been adopted by our schools, together with a current monthly publication printed by another manufacturer.

It was in a sense pathetic, although gratifying, to note the intense eagerness with which the individual members at the various blasters' schools took up this innovation. While familiarity may, and does, breed a certain contempt for danger, yet to be constantly handling material of the dangerous potentialities of dynamite without knowing much more about it other than that it is a frightful and constantly treacherous menace and at the same time being conscious of the handicap of insufficient mental endowment and training to obtain complete mastery of the menace is a mental picture to excite the interest and sympathies of all who enjoy better material and social advantages.

The writer at first was skeptical as to the reception the older men might accord the inauguration of the blasters' school because of a possible and natural prejudice against more modern and progressive methods of handling explosives. But after the initial session of the first plant school started, such doubts were dissipated and in truth utterly banished, we found, happily, that most of our men were of the progressive type. While it is true that at our older mines and quarries the superintendents had for the past 20 years given a great deal of time and attention to the safe handling of explosives, the work was nothing like so thorough as at the present time.

School sessions are held at convenient times during some specific day, during the week or month, suitable to the men; either on company's time or on the men's own time as seem most advisable. At some plants the members of the blasters' school are also members of the safety committee and the school session is held jointly with the safety committee or following its meeting. The standard frequency of each school meeting is once a month. However, at many of the plants the interest created in the subjects treated has caused the men to ask for more frequent meetings, and at several plants meetings are held every week or every two weeks.

Unquestionably, the morale of the loaders and shooters themselves, as well as the employes in general, has improved by virtue of the general knowledge that the handling of explosives is being conducted in the safest possible manner and is being given constant study by those whose duty it is to use such materials daily.

These schools have been the cause of great satisfaction to the members of the families of employes to know that their fathers, husbands and brothers never before worked in an atmosphere of such safety, nor enjoyed a sense of such freedom from anxiety from sudden and dire explosive hazards as at the present time.

The Bureau of Mines states that "explosives caused 20.23 per cent of deaths in quarries, or 0.79 per 1000 men employes, and 1.91 per cent of injuries during the year ending December 31, 1920. The percentage of class total fatalities in 1920 from explosives in mining operations, except coal mining, was 34.21 per cent, and the injured comprised 3.5 per cent.

It is with some degree of satisfaction that we are able to quote our figures in comparison with those quoted above by the Bureau of Mines. Our 11 quarry plants suffered no fatalities due to explosives, either during the year 1920 or 1921.

Making Cement Plants 100 Per Cent Safe

PERHAPS it is constant association with the painstaking and exacting care required in the manufacture of portland cement that makes cement plant employes past masters at the art of avoiding accidents.

Naturally, one of the first steps was to install safety devices at all points of possible danger. Guards were put in place on moving machinery, electrical hazards were safeguarded, and the workmen were supplied with safety belts, goggles and other protective equipment.

Aided by the Bureau of Accident Prevention and Insurance of the Portland Cement Association, this work is well systematized. It is made possible by the co-operative support of the 87 cement members.

The No-Accident-Month idea has been so successful that 100 per cent results have been obtained at a number of plants where long periods have passed without a single workman's being injured in any way. At one of the plants, employing 350 men, only five minor accidents, causing a loss of 20 days' time, occurred during the year 1921.

Quarried from Life

By Liman Sandrock

The Head of a Happy Business Family

TO our mind, the wise interviewer will browse about among his subject's associates if he would learn something intimate and praiseworthy concerning that subject—his standing with his associates; how he is regarded by those who labor *with* him as well as *for* him.

We did so after our recent talk with A. Acton Hall, president of the Ohio Marble Co., Piqua, Ohio. Of course, we found out many things Mr. Hall was too modest to reveal of his own volition.

"The boss?" said one of this happy business family. "There are many mighty nice things we of the office can truly say of the boss, as we all familiarly call Mr. Hall—his understanding ways and his sense of fairness and justice. These things have made our organization not the ordinary 'office force,' but a big happy family.

"But I doubt very much if he would let us go into details concerning his personality, so you'd better leave them all out."

Well, we had to at least touch upon them. We know that we will not only please that same happy family, but "Ac's" host of friends in the industry, who will doubtless agree with us that he is "a man who is with honor in his own country, and in his own house," to paraphrase Holy Writ.

And now, "let us return to our muttons."

Mr. Hall, an Ohio product, was born into a "safe" business. Joseph Lloyd Hall, his dad, was the founder and president of the famous Hall Safe and Lock Co., of Cincinnati. A safe (and sane) start, eh?

As a boy, young Acton spent his vacations learning some branch of that business. His dad did not believe in boys running around in the streets. After leaving school, in his eighteenth year, he went into the lock department and learned the locksmith's trade. Then into the office as a shipping clerk, gradually occupying every desk, including bookkeeping and sales managership, having in the latter capacity as many as 75 salesmen on the road.

From the Cincinnati office he went to the New York branch office, where he spent a year. Returning to Cincinnati, he married and lived in that city a year. In 1886, however, business had expanded to such an extent that we next find him in San Francisco as co-manager, where he stayed about four years in charge of that office.

Now, just suppose you were the fifth son out of a brood of six. You'd soon believe that your prospects were only a 6-to-1 shot, eh? So did Acton, so he

A. Acton Hall

pulled out, returned to Cincinnati, and spent seven years in the real estate business.

All this is wide-angled experience preparatory to embarking in the stone industry.

By this time he became interested in the Ohio Marble Co., at Piqua, which at that period was a small plant turning out the finer grades of marble dust and marble flour only. It had some three acres of ground. Mr. Hall soon realized the possibilities of this little plant and the stone industry, and thereupon gave his entire time and energies to its development. He moved to Piqua—and here he has remained to this day. During these 25 or more years the little plant has grown into four complete plants and comprises about 800 acres—all under Mr. Hall's active management.

If signs do not fail, Mr. Hall's son, now at Phillips Exeter Academy, will succeed his father. At the early age of nine, young Acton Junior showed manifestations of interest in the business—and here is the proof:

A large contractor with business to discuss with Mr. Hall after business hours, called him by phone at his house. Acton Junior answered the phone, and the following dialogue ensued:

"Is this Mr. Hall?"

"Which Mr. Hall do you want? My dad isn't at home, but if you want to talk business, you might as well tell it to me, for I am going to be the next president of the Ohio Marble Co."

Who said that blood will not tell?

At the present time not one of these United States—nor Alaska, the Hawaiian Islands, nor a province of Canada—but what uses some of the Ohio Marble Co.'s products.

Mr. Hall was largely instrumental in organizing the original Interstate Stone Manufacturers' Association, which afterward became the Ohio Macadam Association, of which he was president for years and always on the executive board. The latter association was really the father of the Agricultural Limestone Association and later of the National Crushed Stone Association; in both of these organizations, Mr. Hall is one of the active directors.

We hope that, some day, Mr. Hall will be inspired to write "The Story of Stone"—give it to the world with its romances, its beauties, and its possibilities. For Mr. Hall firmly believes that its possibilities are indeed marvelous; that the surface has only been scratched.

Well, why not? His ripe years of study and experience; his success as a producer; his keen vision of its future—all are fitting requisites for a historian. Some day we may have among our choicest books "The Story of Stone. By A. Acton Hall."

Found—One Case!

FOUND—Eyeglass case; left in the Registration Room, Hotel LaSalle, during Crushed Stone convention; owner may receive it by addressing XXX, Rock Products Editorial Department.

This case may have a sentimental value—may harbor tender memories. We've known cases of a certain sort to do this, although this thought has no allusion to Mr. Hennessy's celebrated XXX; the XXX are merely used for identification purposes.

As the case had a Virginia oculist's stamp on it, we naturally asked C. M. Hunter of the Pounding Mill Quarry, Pounding Mill, Va., if it was his. No, and W. W. Boxley and Major Stull have their cases, and we thanked Mr. Hunter for being first over the bars to tell us. We may be getting in deep over this matter, but our idea is solely to locate the owner of that case—that eyeglass case.

Editorial Comment

The Need For Associations

Now that the "smoke" of the annual conventions of the various rock products industries has cleared away we can more readily make an appraisal of their worth, and the worth of the national associations which conducted them. And in this connection the first thought that occurs is regret that the activities of these three national associations in the mineral aggregate industry are not more closely co-ordinated.

One objective common to all producers of sand, gravel, crushed stone and slag is obtaining ordinary justice in the matter of distributing cars when a shortage of cars or transportation exists. Year after year the country has been stampeded into car embargoes, which subsequent experience invariably shows were unnecessary and unjust. A united effort by all the users of open-top cars other than coal operators certainly would have far more effect than disconnected, independent kicks.

Another obvious objective is a united attack on the freight structure to bring about a readjustment that would make it impossible to ship a carload of automobiles or furniture a given distance for a less rate than a car of stone, or gravel, or slag. Secretary Hoover, of the Department of Commerce, is himself on record in favor of such a readjustment. Freight rate increases must be made on commodities that can carry such increases; and rates on basic materials must be reduced to a point that encourages their movement.

The National Slag Association is largely a promotional organization. Slag is a much more specific commodity than either stone or gravel. It is a comparatively new material. There are relatively few producers, but these few are almost invariably backed by strong financial interests. Being a new material and there being considerable prejudice against its use at the start, it has been the natural thing for the National Slag Association to develop into a strictly promotional organization to sell the engineering and architectural professions on slag; and in this activity it has been quite successful.

The National Sand and Gravel Association represents producers of a much less specific commodity than slag. It represents an industry where the plant investment varies between such wide limits as $10,000 and $500,000 —an industry that, generally speaking, has not the strong financial backing of the slag industry, nor the interest and sympathy of the railways that both the slag and crushed stone producers commonly have. The one big problem of the sand and gravel industry has therefore been transportation.

Promotional work by the National Sand and Gravel Association presents a much more complex problem than promotional work with a product like slag. Nevertheless, much real progress has been made by the National Association in promotional work by the connections it has already established with such government bureaus as the Division of Building and Housing of the Department of Commerce, the Bureau of Standards, the Bureau of Labor Statistics and the Bureau of Internal Revenue; and with such other organizations as the American Society for Testing Materials.

The advantages of these contacts in adding to the recognition and prestige of the sand and gravel industry are probably not so apparent to the average sand and gravel producer as they will be when it becomes possible to do more aggressive promotional work.

The National Crushed Stone Association, it must be confessed, has been, until the recent convention, more of a social organization than a working one. It was supported largely by three or more local associations and a few strong producers largely on the ground that the industry should have at least the nucleus of a national organization. Through its officers, on occasional visits to Washington, it has established valuable contacts with government bureaus, and it has established the fact in high places that there is a national association.

The promotional problems of the crushed-stone industry are more complex and difficult to solve than in the case either of slag or sand and gravel; for there are many varieties of stone and their uses are as diverse as can possibly be imagined. Even the possibility of advertising and promoting the sale of quarry products as a whole seems remote.

On the other hand, the operating and manufacturing problems of crushed-stone producers are identical; they are numerous and difficult and call for a high degree of expert knowledge. And in their solution by mutual exchange of experience and knowledge should be the strongest bond to hold the crushed-stone industry in one big, strong national association. Add to this the opportunity in certain fields to extend the knowledge and the use of stone and we have the foundation for a very strong and a very large national association in the quarry industry.

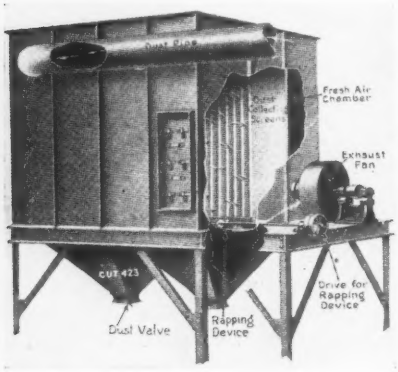
Summarizing, then, we can see that the bond of union in each of the three national associations depends upon distinct common interests: (1) With slag producers the promotion of a specific material in the face of much preliminary prejudice; (2) with sand and gravel producers defense of their transportation rights; (3) with crushed-stone producers investigation and study of the technical side of their industry to reduce costs and hazards and extend the knowledge of the material itself.

Each and every one of these national associations is accomplishing a great deal for the particular industry it represents and each is adding to the prestige and profits of the whole mineral aggregate industry; and each deserves and should have the whole-hearted support of every producer of rock products.

New Machinery and Equipment

A Dust Collector with Positive Filter

A DUST COLLECTOR embodying a positive filter, built in different heights to fit into available head room and in unit lengths so that the capacity can be easily increased, is being manufactured by the W. W. Sly Co., Cleveland. All moving parts



Dust collector with filter

are eliminated as much as possible, the company states.

In this arrester large areas of filtering surface are confined in a comparatively small space. The settling chamber idea is also used in connection with this dust arrester. It is the combination of these two principles in the same apparatus that effects efficient collection and confinement of dusts.

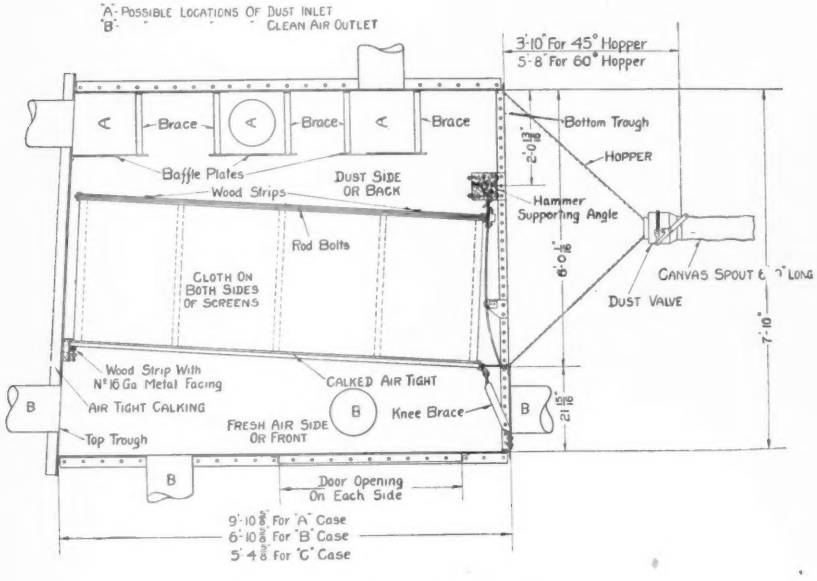
In the three standard types the width is 7 ft. 10 in.; the length varies from 3 ft. up, according to the volume of air handled. The dust hoppers are 6 ft. wide; their length may be 3, 4, 5 or 6 ft., dependent upon the arrester length. Two or more hoppers are furnished with each arrester over 6 ft. in length, so that an arrester 21 ft. long, for instance, has three 5-ft. and one 6-ft. hopper.

The dust arrester case is made up of standard sheets of No. 16 gage blue annealed steel, with seams reinforced, bolted together, and made air-tight with asbestos or tar paper packing. The arrester roof is pitched and projects beyond the case proper to offer a watershed.

Doors of ample size are provided for the inspection of screens and hoppers and to facilitate repairs.

Hoppers with 45- or 60-deg. pitch as required are furnished as standard equipment, and the dust valves are equipped with canvas spouts to keep the dust confined as the hoppers are emptied.

The screens are made of the best grade of basswood, well braced and strengthened by a series of tinned straps which prevent the cloth from being drawn together. The screen cloth is especially woven to insure uniformity in strength and texture.

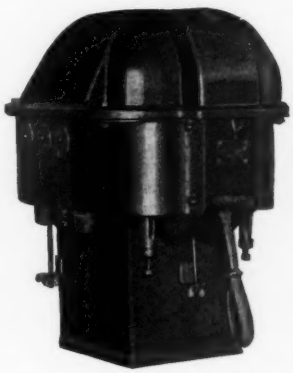


Cross-sectional drawing of dust collector

Oil Circuit Breakers for Industrial Use

THE type F-10 oil circuit breakers, designed primarily for application in mines and in textile, cement, and flour mills, have been placed on the market by the Westinghouse Electric and Mfg. Co.

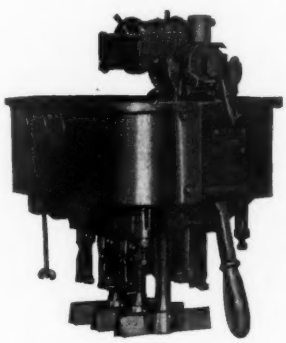
These breakers are of moderate interrupting ability and are made in capacities up to 200 amp. at 2500 volts and 300 amp.



Oil circuit breaker

at 750 volts. They are wall-mounting breakers, designed for indoor service only. As they are dust and drip proof, they may be used in textile, flour and cement mills where dust is encountered and in mines where there is excessive moisture.

All type F-10 breakers are manually



Oil circuit breaker with cover removed

operated and may be either non-automatic or automatic. The breaker is held in the closed position by a hardened steel roller which is tied on the trigger so that when the trip coil is energized the trigger is raised, disengaging the latch and allowing the breaker to open. When the breaker is

used non-automatically, it is tripped by raising the closing handle. When the breaker is in position, the operating handle is vertical and when the breaker is opened, the handle is raised slightly. It is thereby possible to determine the position of the contacts by the position of the handle.

Automatic operation is obtained by the addition of one or more automatic trip attachments. These attachments consist of series overload coils, with or without dashpot time limit devices, or of undervoltage release attachments, connected directly across the line for low voltages or to the secondary of self-contained or separate voltage transformers for 2500 volts. All automatic breakers are full-automatic—that is, it is impossible to hold the breaker in the closed position when a predetermined tripping condition exists.

The breaker construction is such that the entire equipment can be assembled, lined up, and the contacts and auxiliaries adjusted, either below or above the frame, before the tank or cover is placed in position, making possible quick and accurate replacements and adjustments.

The breaker frame or housing is made of heavy cast iron and the breakers are supported by bolting the frame proper to the wall or any flat vertical surface. The rectangular oil tanks are made of heavy sheet iron with all seams lapwelded, the bottom being flanged and welded on the outside of the tank sides. Sufficient space is allowed in the tanks for oil expansion and for bubbles caused by the arc gases, so that no insulating lining material is needed.

The gases are vented through the clearance between the operating rods and the breaker framework and between the operating handles and the framework. The lifting lever, attached to the crossbar, clamps the especially constructed wood operating rod and is operated through a toggle so constructed that the pressure on the contacts at the end of the moving contacts' travel is overcome easily by the operator during the closing operation.

Vibrationless Shaking Screen

WHILE the shaking type of screen has always been known to produce a clean product, until very recently these screens have possessed two disadvantages: first, they required very heavy supports because of the vibration transmitted to the structure on which they are placed; second, their maintenance cost was high, due to the heavy wear on the moving parts.

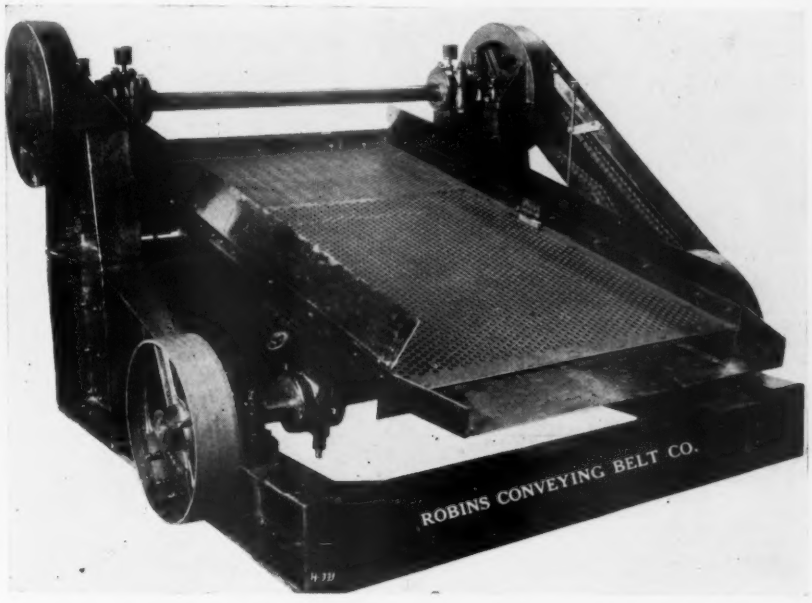
The Robins Conveying Belt Co., New York City, claims for its Grasshopper screen that both of these drawbacks have been completely eliminated without diminishing the high screening efficiency obtainable on a screen of this type. Its construction is extremely simple.

A rugged cast-iron frame supports two shafts connected by a roller chain transmission. These shafts carry four short-throw eccentrics, one attached to each corner of the rectangular screen plate. The drive is transmitted to a pulley on the lower shaft and the transmsision between the two shafts is so arranged that both travel at the same speed (275 r.p.m.) turning in the direction of the flow of material over the screen. This imparts to the screen plate a circular up-and-down motion, even and uniform on all parts of the screen surface.

The most novel and ingenious feature of the mechanism, however, is that, by means of counterweights, the vibrating forces of the screen are so counterbalanced that no strains or vibrations are transmitted to the base of the screen or the supporting structures—in fact, it is possible to place a coin on the inclined surface of the supporting frame without the coin being shaken from its position.

Other outstanding features of this machine are: 1. Every inch of the surface is at all times effective screening area. This means low power consumption in relation to capacity. 2. In handling wet sand and gravel and other sticky materials the screen does not clog; the screen will eject 4-in. bolts placed in the openings. 3. The screen is simply though heavily constructed, with interchangeable parts. Only one size is made, having a screening surface 4x7 ft. Capacity tests show efficient screening at 75 to 100 tons an hour passing 70 per cent undersize through. 4. At slightly increased cost the machine can be double-decked, giving three products instead of two. 5. The Grasshopper screen takes only 3 ft. 10 in. headroom and is less than 7 ft. long.

Two of these screens have been in service at the Arundel Corp. plants for two years and, according to the owners, have given excellent results. The maintenance charges have been virtually nil, although the screens have run winter and summer.



By means of counterweights the vibrating forces of the screens is counterbalanced

Marble From Central America

THE first exportation of marble ever made from Guatemala, and so far as known from any country of Central America, occurred on November 21, 1922, when 437 cu. ft. were sent from Puerto Barrios to New York. Two other lots were shipped December 2, one lot of 221 cu. ft. for New Orleans, and 267 cu. ft. destined for Peoria, Ill.

An American concern has been developing a deposit at Marmol, Department of Zacapa, Guatemala, for many years, but lack of technical skill, capital, and especially the means of transportation between the mine and the railroad has greatly delayed efforts at exploitation. The management of the company declares that its marble is on a par with, or superior to, the Carrara marble, being harder, more enduring, non-absorbent and without sand holes or flint, says Consul Arthur C. Frost, in a report to the Department of Commerce.

SAND IN ICELAND is transported without any freight cost—in fact, the "Icers" are forced to build walls and vegetation barriers to keep it from drifting in their front yards. Sometimes sand storms last for two weeks, hiding the sun, creating a fog, and everything!

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Blakeslee, N. Y.	1.00	1.25	1.10	1.10	1.10	.....
Buffalo, N. Y.	1.50 per net ton all sizes					
Chaumont, N. Y.	1.00	.....	1.50	1.25	1.25	1.25
Cobleskill, N. Y.	1.25	1.25	1.25	1.25	.....	.....
Coldwater, N. Y.	1.50 per net ton all sizes					
Eastern Penna.	1.35	1.35	1.35	1.35	1.35	1.35
Munns, N. Y.	1.00	1.25	1.25	1.25	1.25	.....
Prospect, N. Y.	.80	1.25	1.25	1.25	1.25	.....
Walford, Pa.	1.55	1.55	1.55	1.55	1.55	1.55
Watertown, N. Y.	.....	.....	1.50	1.25	1.25	1.25
Western New York	.75	1.20	1.20	1.20	1.20	1.20
CENTRAL:						
Alton, Ill.	.....	.....	1.50	.....	.....	.....
Buffalo, Iowa	.90	.....	1.35	1.15	1.20	1.20
Chasco, Ill.	1.30	1.25	1.25	1.25	1.20	.....
Chicago, Ill.	1.30	1.70	1.30	1.30	1.30	.....
Dundas, Ont.	1.00	1.35	1.35	1.25	1.10	1.10
Greencastle, Ind.	1.25	1.10	1.00	.90	.90	.90
Krause, Columbia and Valmeyer, Ill.	1.00@1.30	1.00@1.30	1.00@1.30	1.00@1.30	1.00@1.30	1.30@1.50
Lannon, Wis.	.85	.....	1.05	.95	.95	.95
Mitchell, Ind.	.80	.80	.80	.80	.80	.80
Montreal, Canada	.80	1.35	1.05	.95	.90	.....
Montrose, Iowa	.....	1.50	1.60	1.55	1.45	1.40
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Southern Illinois	1.35	1.40	1.35	1.30	1.25	.....
Stolle, Ill. (I. C. R. R.)	1.30	.....	1.35	1.35	1.35	1.35
Stone City, Iowa	.75	.....	1.40	1.30	1.25	.....
Toledo, Ohio	1.60	1.70	1.70	1.70	1.60	1.60
Toronto, Canada	1.90	2.25	2.25	2.25	2.00	2.00
Waukesha, Wis.	Prices include 90c freight All sizes 1.00 per ton					
SOUTHERN:						
Alderson, W. Va.	.75	1.25	1.40	1.25	1.15	.....
Bridgeport, Texas	1.25	1.25	1.40	1.40	1.40	1.25
Bromide, Okla.	.75	2.00	1.75	1.60	1.50	1.25
Cartersville, Ga.	.....	2.00	1.25	1.25	1.25	.....
Chickamauga, Tenn.	.75@1.00	.90@1.25	.....	.75@1.00	.75@1.00	.....
El Paso, Texas	1.00	1.00	1.00	1.00	1.00	.....
Ft. Springs, W. Va.	.60	1.15	1.40	1.35	1.20	.....
Garnet and Tulsa, Okla.	.50	1.60	1.60	1.45	1.45	.....
Ladds, Ga.	.....	.....	1.40	1.40	1.40	.....
Morris Spur (near Dallas), Tex.	1.25	1.25	1.40	1.40	1.40	1.25
WESTERN:						
Atchison, Kans.	.50	1.80	1.80	1.80	1.80	1.80
Blue Spr'gs and Wymore, Neb.	.25	1.65	1.65	1.55	1.45	1.40
Cape Girardeau, Mo.	1.35	.....	1.10	1.35	1.10	.....
Kansas City, Mo.	1.00	1.50	1.50	1.50	1.50	1.40

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.50	1.30	1.10	1.00	.....
Bound Brook, N. J.	1.80	2.30	1.90	1.50	1.40	.....
Dresser Jct., Wis.	1.00	2.25	.....	1.75	2.00	.....
Duluth, Minn.	.90@1.00	2.00@2.25	1.75@2.00	1.40@1.50	1.30@1.40	.....
E. Summit, N. J.	2.30	2.50	2.20	1.90	1.60	.....
Eastern Massachusetts	.60	1.85	1.40	1.40	1.40	1.40
Eastern New York	.75	1.50	1.30	1.30	1.40	1.40
Eastern Pennsylvania	1.25	1.70	1.60	1.50	1.40	1.40
New Britain, Middlefield, Rocky Hill, Meriden, Conn.	.60	1.35@1.45	1.15@1.25	1.05	.95@1.00	.....
Oakland, Calif.	1.75	1.75	1.75	1.75	1.75	.....
Richmond, Calif.	.50*	.....	1.50*	1.50*	1.50*	.....
Spring Valley, Calif.	.70	1.55	1.50	1.40	1.35	1.35
Springfield, N. J.	2.00	2.25	2.10	1.85	1.85	.....
Westfield, Mass.	.60	1.35	1.25	1.10	1.00	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Buffalo, N. Y.—Granite	.90	.....	1.20	1.00	1.05	1.10
Berlin, Utley and Red Granite, Wis.	1.60	1.70	1.60	1.50	1.40	.....
Columbia, S. C.—Granite	.50	.....	2.00@2.50	2.00	.....	1.75@2.00
Dundas, Ont.—Limestone	1.00	1.35	1.35	1.25	1.10	1.10
Eastern Penna.—Sandstone	.85	1.55	1.55	1.40	1.35	1.30
Eastern Penna.—Quartzite	1.20	1.30	1.20	1.20	1.20	1.20
Lithonia, Ga.—Granite	1.00	.....	1.50	1.25	1.00	1.00
Lohrville, Wis.—Cr. Granite	1.35	1.40	1.30	.....	1.20	.....
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.50
San Diego, Calif.	.50@ .70	1.45@1.75	1.40@1.70	1.30@1.60	1.25@1.55	1.25@1.55
Sioux Falls, S. D.—Granite	1.00	1.60	1.55	.....	1.50	.....

*Cubic yard. †Agrl. lime. ‖R.R. ballast. §Flux. ‡Rip-rap, a 3-inch and less.

Agricultural Limestone

(Pulverized)

Chaumont, N. Y. — Analysis, 95% $CaCO_3$, 1.14% $MgCO_3$ — Thru 100 mesh; sacks, 4.00; bulk	2.50
Grove City, Pa. — Analysis 94.89% $CaCO_3$, 1.50% $MgCO_3$; 60% thru 100 mesh; 45% thru 200 mesh; sacks, 5.00; bulk	3.50
Hillsville, Pa.—Analysis, 90% $CaCO_3$ 1.00% $MgCO_3$; 90% thru 100 mesh; sacks, 5.00; bulk	3.50
Jamesville, N. Y. — Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
New Castle, Pa.—89% $CaCO_3$, 1.4% $MgCO_3$—75% thru 100 mesh, 84% thru 50 mesh, 100% thru 10 mesh; sacks, 4.75; bulk	3.06
Walford, Pa.—Analysis, 50% thru 100 mesh; 4.50 in paper; bulk	3.00
Watertown, N. Y. — Analysis, 96% $CaCO_3$; .02% $MgCO_3$; all pass 100 mesh; bulk, 2.50; sacks	4.00
West Stockbridge, Mass., Danbury, Conn., North Pownal, Vt.—Analysis, 90% $CaCO_3$—50% thru 100 mesh; paper bags, 4.25—cloth, 4.75; bulk	3.00
Alton, Ill.—Analysis, 97% $CaCO_3$, 0.1% $MgCO_3$; 90% thru 100 mesh	5.00
99% thru 200 mesh	8.00
Belleville, Ont. — Analysis, 90.9% $CaCO_3$, 1.15% $MgCO_3$—45% to 50% thru 100 mesh, 61% to 70% thru 50 mesh; bulk	2.50
Chasco, Ill.—Analysis 96.12% $CaCO_3$, 2.5% $MgCO_3$; 90% thru 100 mesh	5.00
Pulverized limestone	1.35
Detroit, Mich.—Analysis, 88% $CaCO_3$, 7% $MgCO_3$—75% thru 200 mesh, 2.50@4.75—60% thru 100 mesh	1.80@3.80
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; sacks	4.50
Bulk	3.00
Piqua, Ohio—70% thru 100 mesh; bags, 5.00; bulk	3.50
90% thru 100 mesh; bags, 7.00; bulk	5.50
Yellow Springs, Ohio—Analysis 96.08% $CaCO_3$, 63% $MgCO_3$; 32% thru 100 mesh; 95.57%, sacked, 6.00; bulk	4.25
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; 50% thru 100 mesh	1.50
Hot Springs, N. C. — 50% thru 100 mesh; sacks, 4.25; bulk	2.70
Knoxville, Tenn.—80% thru 100 mesh	2.70
Linville Falls, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; bulk	2.75
Mountville, Va. — Analysis, 76.60% $CaCO_3$, 22.83% $MgCO_3$—50% thru 100 mesh; 100% thru 20 mesh; sacks	5.00
Colton, Calif.—Analysis, 95% $CaCO_3$, 3% $MgCO_3$—all thru 20 mesh—bulk	4.00
Lemon Cove, Calif. — Analysis 94.8% $CaCO_3$, 0.42% $MgCO_3$; 60% thru 200 mesh; sacks, 5.25; bulk	4.50

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis, 98% $CaCO_3$, 0.1% $MgCO_3$; 90% thru 50 mesh	1.50
Bellevue, Ohio — Analysis, 61.56% $CaCO_3$, 36.24% $MgCO_3$; ¼ in. to dust, about 20% thru 100 mesh	1.25
Bettendorf, Ia., and Moline, Ill.—97% $CaCO_3$, 2% $MgCO_3$—50% thru 100 mesh; 50% thru 4 mesh	1.50
Buffalo, Ia.—90% thru 4 mesh	1.00
Cape Girardeau, Mo. — Analysis, 93% $CaCO_3$, 3.3% $MgCO_3$; 50% thru 4 mesh	1.35
90% thru 4 mesh, cu. yd.	1.35
Chicago, Ill.—Analysis, 53.63% $CaCO_3$, 37.51% $MgCO_3$; 90% thru 4 mesh	1.00
Columbia, Ill., near East St. Louis—½-in. down	1.25@1.80
Elmhurst, Ill. — Analysis, 35.73% $CaCO_3$, 20.69% $MgCO_3$ — 50% thru 50 mesh	1.25
Huntington and Bluffton, Ind.—Analysis 61.56% $CaCO_3$, 36.24% $MgCo_3$; about 20% thru 100 mesh	1.25
Greencastle, Ind. — Analysis, 98% $CaCO_3$—50% thru 50 mesh	2.00
Kansas City, Mo.—50% thru 100 mesh	1.50
Krause and Columbia, Ill.—Analysis, 90% $CaCO_3$, 90% thru 4 mesh	1.20

(Continued on next page)

Agricultural Limestone

(Continued from preceding page)

Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh 2.00
Screenings (¼ in. to dust) 1.00
Marblehead, O.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; screenings, 40% thru 100 mesh, 53% thru 50 60% thru 100 mesh, 70% thru 50 mesh, 100% thru 10 mesh; sacks, 5.00; bulk 3.50
Milltown, Ind.—Analysis 94.41% $CaCO_3$, 2.95% $MgCO_3$; 33.6% thru 100 mesh, 40% thru 50 mesh ..... 1.25@1.65
Mitchell, Ind.—Analysis, 97.65% $CaCO_3$, 1.76% $MgCO_3$, pulverized limestone 1.50
Montrose, Ia.—90% thru 100 mesh 1.25
Narlo, Ohio—Analysis 56% $CaCO_3$, 43% $MgCO_3$, limestone screenings, 37% thru 100 mesh; 55% thru 50 mesh; 100% thru 4 mesh ..... 1.50@2.00
Ohio (different points), 20% thru 100 mesh; bulk ..... 1.25@1.50
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk ..... .80@1.40
Stolle, Ill., near East St. Louis on I. C. R. R.—Thru ¼-in. mesh 1.30
Stone City, Ia.—Analysis, 98% $CaCO_3$ 50% thru 50 mesh ..... .75
Toledo, Ohio—¼-in. to dust, 20% thru 100 mesh 1.00
Waukesha, Wis.—No. 1 kiln dried 2.00
No. 2 Natural 1.75
Alderson, W. Virginia—Analysis 90% $CaCO_3$; 90% thru 50 mesh 1.75
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$ 2.00
90% thru 4 mesh 1.50
Cartersville, Ga.—Analysis 66% $CaCO_3$, 33% $MgCO_3$—all passing 10 mesh 1.75
Claremont, Va.—Analysis, 92% $CaCO_3$, 2% $MgCO_3$; 90% thru 50 mesh 3.00
50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh 2.75
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$—90% thru 50 mesh 1.50
Ladds, Ga.—50% thru 50 mesh 2.00
Garnett, Okla.—Analysis, 80% $CaCO_3$, 3% $MgCO_3$; 50% thru 50 mesh ..... .50
Kansas City, Mo., Corrigan Sid'g—50% thru 100 mesh; bulk 1.80
Tulsa, Okla.—90% thru 4 mesh ..... .50

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated.

GLASS SAND:

Berkeley Springs, W. Va. ..... 2.00@2.25
Cedarville and South Vineland, N. J.—Damp, 1.75; dry 2.25
Cheshire, Mass. ..... 5.00@10.00
Columbus, Ohio ..... 1.50@ 2.00
Dunbar, Pa. (damp) 2.50
Falls Creek, Pa. 2.25
Hancock, Md.—Damp, 1.50; dry 2.00
Klondike and Pacific, Mo. 2.50
Mapleton, Pa. ..... 2.00@ 2.50
Mapleton Depot, Pa.—Damp, 2.00; dry 2.75
Massillon, Ohio 3.00
Michigan City, Ind. ..... .50@ .55
Mineral Ridge, Ohio ..... 2.75@ 3.00
Montoursville, Pa. 2.00
Oregon, Ill. ..... 1.50@ 2.00
Ottawa, Ill. 2.50
Pittsburgh, Pa.—Dry, 4.00; damp 3.00
Rockwood, Mich. ..... 2.50@ 3.00
Round Top, Md. 2.25
Sands, Pa. 2.50
San Francisco, Cal. ..... 3.00@ 3.50
St. Mary's, Pa. 3.00
Thayers, Pa. 2.50
Utica, Ill. 1.50
Zanesville, Ohio ..... 2.00@ 2.50

FOUNDRY SAND:

Albany, N. Y.—Sand blast (dry) 4.00
Molding fine and brass molding 2.50
Molding coarse 2.25
Allentown, Pa.—Core and molding fine ..... 1.50@1.75
Arenzville, Ill.—Molding fine ..... 1.50@1.75
Brass molding 1.75
Beach City, O.—Core, washed and screened ..... 2.00@2.50
Furnace lining ..... 2.50@3.00
Molding fine and coarse ..... 2.25@2.50
Cheshire, Mass.—Furnace lining, molding, fine and coarse 5.00
Sand blast ..... 5.00@8.00
Stone sawing 6.00
Cleveland, O.—Molding coarse ..... 1.50@2.00
Brass molding ..... 1.50@2.00
Molding fine ..... 1.50@2.25
Core ..... 1.25@1.50
Columbus, Ohio—Core ..... .50@1.50
Sand blast ..... 3.50@5.00
Molding fine ..... 2.75@3.00
Molding coarse ..... 2.50@3.00
Brass molding ..... 2.50@3.00

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 inch down	Sand, ¼ inch and less	Gravel, ½ inch and less	Gravel, 1 inch and less	Gravel, 1½ inch and less	Gravel, 2 inch and less
EASTERN:						
Ambridge and So. Heights, Pa.	1.15	1.15	1.15	1.15	.70	.70
Erie, Pa.		.60	.90		1.00	
Farmingdale, N. J.	.48	.48	1.00	1.00	1.20	
Hartford, Conn.	.90		1.25	1.15	1.15	1.15
Leeds Junction, Me.		.50	1.75	1.35	1.35	1.25
Machias, N. Y.	.75	.75	1.50	.85	.85	.85
Pittsburgh, Pa.	1.15	1.15	1.00	.70	.70	.70
Portland, Maine		.50	1.75		1.35	1.35
Washington, D. C. (rewashed, river)	.75	.75	1.60	1.40	1.20	1.20
CENTRAL:						
Alton, Ill.		.85				
Anson, Wis.	.50	.40				.90
Barton, Wis.	.60	.60	.70	.70	.70	.70
Beloit, Wis.		.70			.80	
Chicago, Ill.		1.75@2.23	1.75@2.43			
Cincinnati, Ohio	.70	.65	.90	.90	.90	.96
Columbus, Ohio	.75	.75@1.00	.75@1.00	.75@1.00	.75@1.00	.75@1.00
Des Moines, Iowa	.50	.50	1.60	1.60	1.60	1.60
			Unwashed ballast .50 ton			
Farlestead (Flint), Mich.	.70		60-40 sieves, .85; Pebbles, .95			
Eau Claire, Wis.	.50	.45	1.25			.90
Elkhart Lake, Wis.		.50			.60	.60
Ft. Dodge, Ia.		1.22		2.17		
Grand Rapids, Mich.		.50		.80		.70
Hamilton, Ohio		.90			.90	
Hawarden, Ia.		.50			1.60	
Hersey, Mich.	.40	.40			.70	
Indianapolis, Ind.	.60	.60		1.50	.75@1.00	.75@1.00
Janesville, Wis.		.65@ .75			.65@ .75	
Mason City, Ia.	.70	.60	1.50	1.75	1.65	1.60
Mankato, Minn. (pit run)	.50	.40	.40		1.25	
Milwaukee, Wis.	1.06	1.06	1.26	1.26	1.26	
Minneapolis, Minn.	.35	.35	1.25@1.35	1.25@1.35	1.25	1.25
Moline, Ill.	1.00	1.00	1.60	1.60	1.60	1.60
Riton, Wis.		.60			.80	
St. Louis, Mo., f.o.b. cars	1.20	1.45	1.65	1.45		1.45
St. Louis, Mo., deliv. on job	2.05	2.20	2.35	2.15		2.10
Summit Grove, Clinton, Ind.	.65@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75	.60@ .75
Terre Haute, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.	.50	.50	.80	.80	.80	.80
			(.05 ton discount 10 days)			
Winona, Minn.	.40	.40	1.25	1.25	1.10	1.10
SOUTHERN:						
Birmingham, Ala.	1.48		all gravel 1.88			
Charleston, W. Va.	all sand 1.40		all gravel 1.50			
Estill Springs, Tenn.	**1.35**	**1.15**		**1.00**	**.85**	**.65**
Ft. Worth, Tex.	1.50@2.00	1.50@2.00	1.50@2.00	1.50@2.00	1.50@2.00	1.50@2.00
Jackson's Lake, Ala.	.50@ .60	.50@ .60	.40@1.00	1.00	.50@1.00	.50@1.00
Knoxville, Tenn.	.75@1.00	.75@1.00		1.00	1.00	1.00
Lake Weir, Fla.		.60				
Macon, Ga.		.50@ .75				
Memphis, Tenn.	1.00	1.00	1.80	1.80	1.80	1.80
N. Martinsville, W. Va.		1.00	1.20		1.00	.80
New Orleans, La.		.50			1.00	
Roseland, La.		.25		.85		
WESTERN:						
Grand Rapids, Wyo.	.50	.50	.85	.85	80	.80
Kansas City, Mo.	(Kaw River sand, car lots, .75 per ton. Missouri River, .85)					
Los Angeles, Calif.		.70	1.20	1.20	1.10	1.10
Pueblo, Colo.	1.10*	.90*		1.50*		
San Diego, Calif.	.50@ .70	.80@1.00	1.30@1.60	1.35@1.65	1.10@1.40	1.10@1.40
San Francisco, Calif.		1.00	1.00@1.20	.85@1.00	.85@1.00	.85@1.00
Seattle, Wash.	1.00*	1.00*	1.00*	1.00*		1.00*
Spring Valley, Calif.	**.70**	**.80**	**1.40**	**1.35**	**1.25**	**1.25**

Bank Run Sand and Gravel

City or shipping point—	Fine sand, 1/10 inch	Sand, ¼ inch	Gravel, ½ inch	Gravel, 1 inch	Gravel, 1½ inch	Gravel, 2 inch
Boonville, N. Y.	.60@ .80		.55@ .75			1.00
Cape Girardeau, Mo.			River sand, 1.00 per yd.			
Cherokee, Iowa			.80 per ton—1.20 washed			
Dudley, Ky. (crushed sand)	1.00	1.00		.90		
East Hartford, Conn.			.65 per cu. yd.			
Elkhart Lake, Wis.	.70	.50			.60	.60
Estill Springs, Tenn.						.85
Fishers, N. Y.		.50@ .65		.50@ .65		
Grand Rapids, Mich.						.50
Hamilton, Ohio			.45 per cu. yd. in pit			
Hartford, Conn.		1.00*				
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, .65			
Lindsay, Texas					.55	
Janesville, Wis.		.65		.65@ .75		
Montezuma, Ind.			Road gravel .50 per ton			
Pine Bluff, Ark.			Road gravel .50			
Rochester, N. Y.	.60@ .75	.60@ .75		.50@ .65	.50@ .65	
Roseland, La.		.75				
Saginaw, Mich., f.o.b. cars		.75	1.30	1.30	1.30	1.30
St. Louis, Mo.			60% gravel, 40% sand, 1.55			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waco, Texas		.80		1.50		1.30
Winona, Minn.			Clean pit run .60			
York, Pa.		1.00@1.20	(crushed rock sand)			

* Cubic yard. B Bank. L Lake. || Ballast.

Crushed Slag

City or shipping point	Roofing	¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:							
Buffalo, N. Y.	2.35	1.35	1.35	1.35	1.35	1.35	1.35
E. Canaan, Conn.	4.00	1.00	2.50	1.35	1.25	1.25	1.25
Eastern Pennsylvania and Northern New Jersey	2.00	1.20	1.50	1.20	1.20	1.20	1.20
Easton, Pa.	2.00	.80	1.25	.90	.85	.80	.80
Erie, Pa.	2.35	1.35	1.35	1.35	1.35	1.35	1.35
Emporium, Pa.			1.35	1.35	1.35	1.35	1.35
Sharpsville and West Middlesex, Pa.	2.00	1.30	1.70	1.30	1.30	1.30	1.30
Western Pennsylvania	2.00	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Chicago, Ill.			All sizes, 1.50, F. O. B. Chicago				
Detroit, Mich.			All sizes, 1.65, F. O. B. Detroit				
Cronton, O.	2.05	1.45	1.80	1.45	1.45	1.45	1.45
Steubenville, O.	2.00	1.40	1.70	1.40	1.40	1.40	1.40
Toledo, O.	1.75	1.50	1.50	1.50	1.50	1.50	1.50
Youngstown, Dover, Hubbard, Leetonia, Struthers, O.	2.00	1.25	1.50	1.25	1.25	1.25	1.25
Steubenville, Lowellville and Canton, O.	2.00	1.35	1.60	1.35	1.35	1.35	1.35
SOUTHERN:							
Ashland, Ky.		1.55		1.55	1.55	1.55	1.55
Birmingham, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Ensley, Ala.	2.05	.80	1.25	1.15	1.10	.95	.85
Longdale, Goshen, Glen Wilton & Low Moor, Roanoke, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.05

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing Hydrate	Masons' Hydrate	Agricultural Hydrate	Chemical Hydrate	Ground Burnt Lime Blk.	Ground Burnt Lime Bags	Lump Lime Blk.	Lump Lime Bbl.
EASTERN								
Adams, Mass.			7.00				2.90	
Bellefonte, Pa.		10.50§	10.50§	10.50§	9.00		8.50	1.80
Buffalo, N. Y.		12.00		12.00				
Berkley, R. I.			12.00					2.30
Cassadaga, N. Y.			Agricultural marl 7.00@10.00					
Chaumont, N. Y.					2.50	4.00		
Lime Ridge, Pa.							5.00	
West Rutland, Vt.	13.50	12.00					11.00	3.20
West Stockbridge, Mass.								2.25
Williamsport, Pa.			10.00			10.00	6.00	
York, Pa. (dealers' prices)		10.50	10.50				10.50	1.65*
Zylonite, Mass.	3.20d	2.90d	7.00					
CENTRAL:								
Delaware, Ohio	11.50	10.00	9.50	10.50			9.00	1.60
Gibsonburg, Ohio	11.50	10.00	10.00		8.00		9.00	
Huntington, Ind.		10.00					9.00	
Luckey, Ohio	11.50	10.00	10.00					
Marblehead, Ohio		10.00					9.00	1.60
Marion, Ohio		10.00	10.00				9.00	
Mitchell, Ind.				12.00	11.00		10.00	1.60
Sheboygan, Wis.								7.50d
White Rock, Ohio	11.50				8.00	10.00		
Woodville, O. (dlrs.' price)	11.50a	10.00a	10.00a	11.00a			9.00	1.60
SOUTHERN:								
Erin, Tenn.							8.50	1.50
El Paso, Tex.							7.00	1.50
Karo, Va.							**7.00**	**1.30**
Knoxville, Tenn.	18.00	11.00@12.00		11.00@12.00	10.00	11.00	8.50	1.50
Ocala and Zuber, Fla.	13.00		12.00				12.00	1.60
Sherwood, Tenn.	12.50	11.00		8.50			8.50	1.50
Staunton, Va.					4.50	5.50	8.50	1.35
WESTERN:								
Colton, Calif.			15.00				19.70	
Kirtland, N. M.							12.50	
San Francisco, Calif.	22.00	22.00	15.00	22.00			16.00	2.15*
Tehachapi, Calif.							13.00	2.10

‡100-lb. sacks; *180-lb. net, price per barrel; †180-lb. net, non-returnable metal barrel; §Paper sacks. (a) 50-lb. paper bags; terms, 30 days net; 25c per ton or 5c per bbl. discount for cash in 10 days from date of invoice. (b) Burlap bags. (c) 200-lb. bbl. (d) 280-lb. bbl. net.

Miscellaneous Sands

(Continued from preceding page)

Delaware, N. J.—Molding fine	2.00
Molding coarse	1.90
Brass molding	2.15
Dunbar, Pa.—Traction, damp	2.50
Dundee, O.—Glass, core, sand blast, traction	2.50
Molding fine, brass molding (plus 75c for winter loading)	2.00
Molding coarse (plus 75c for winter loading)	1.75
Eau Claire, Wis.—Core	1.00
Sand blast	3.25@3.75
Falls Creek, Pa.—Molding, fine and coarse	1.75
Sand blast	2.00
Traction	1.75
Franklin, Pa.—Core	1.25@1.75
Furnace lining	2.50
Molding fine	2.00
Molding coarse	1.75
Brass molding	2.00
Greenville, Ill.—Molding coarse	1.75@2.00
Joliet, Ill.—No. 2 molding sand and loam for luting purposes; milled	.80
Bank run	.65
Kansas City, Mo.—Missouri River core	.80
Kasota, Minn.—Stone sawing	**1.30@1.50**
Klondike, Pacific, Gray Summit, Mo.—Molding fine and coarse	2.00
Molding fine	2.00
Mapleton, Pa.—Glass, core, furnace lining, molding fine and coarse; damp 2.00, dry	2.75
Massillon, O.—Molding fine and coarse, furnace lining, core	2.75
Brass molding	3.00
Traction	2.50
Michigan City, Ind.—Core, traction	.40@ .45
Mineral Ridge, Ohio—Core, molding fine, sand blast (green)	2.25
Furnace lining (green)	1.75@2.00
Roofing sand, stone sawing, traction (green)	2.00
Sand blast (dry)	2.75
Montoursville, Pa.—Core	1.25@1.35
Traction	**1.00**
Molding fine	1.50
Molding coarse	1.50@2.00
New Lexington, O.—Molding fine	2.00
Molding coarse	1.75
(.75 extra per ton for winter loading)	
Oregon, Ill.—Core	1.50@2.00
Sand blast	3.50@4.00
Stone sawing	2.00@2.50
Ottawa, Ill.—Core, molding, steel, traction, roofing sand	2.00
Brass molding	3.00
Sand blast	4.00
Stone sawing	3.50
Furnace lining, molding coarse (crude)	1.25@1.50
Ottawa, Minn.—All crude silica sand	.75@1.00
Rockwood, Mich.—Core	1.90
Roofing	3.00
Sand blast	3.75
Round Top, Md.—Glass sand	1.75@2.00
Core, furnace lining	1.45
Traction	1.60

(All per 2000 lb.)

Miscellaneous Sands

(Continued)

San Francisco, Cal. (Washed and dried)—Core, molding fine, roofing sand and brass molding	3.00@3.50
Direct from pit.	
Furnace lining, molding coarse, sand blast	3.60
Stone sawing, traction	2.30
Thayers, Pa.—Core	2.00
Furnace lining	1.25
Molding fine and coarse	1.25
Traction	2.00
Utica, Ill.—Core	75@1.50
Furnace lining	1.00@1.50
Molding coarse	.75@1.50
Stone sawing, roofing sand	1.50@2.50
Sand blast	2.50
Molding fine, traction and brass molding	1.50
Utica, Pa.—Core	1.25@2.25
Molding fine and coarse, traction, brass molding	2.00
Warwick, Ohio—Core, furnace lining, molding coarse; green, 2.00; dry	2.50
Molding fine, traction, dry	2.50
Brass molding fine	2.25
Zanesville, Ohio—Core	2.00
Furnace lining	6.00
Molding fine	1.75@2.00
Molding coarse	1.75
Brass molding	1.75@2.00

Talc

Prices given are per ton f. o. b. (in carload lots only) producing plant, or nearest shipping point.

Baltimore, Md.—Ground talc (20-50 mesh), bags	10.00
Ground talc (150-200 mesh), bags	12.00
Cubes	50.00
Blanks (per lb.)	.07
Chatsworth, Ga.—Grinding	6.00
Ground talc (150-200 mesh); bags	10.00
Pencils and steel workers' crayons (gross)	1.50@ 2.50
Chester, Vt.—Crude talc	5.00
Ground talc (150-200 mesh), bulk	6.50@ 8.50
Emeryville, N. Y.—200-325 mesh; bags	14.75
Glendale, Calif.—Ground talc (150-200-mesh)	16.00@30.00
(Bags extra)	
Ground talc (50-300 mesh)	13.50@15.50
200 mesh	13.50@14.50
Hailesboro, N. Y.—Ground talc (150-250 mesh), bags	18.00
Henry, Va.—Crude talc (lump mine run) per 2000-lb. ton	2.75@ 3.50
Ground talc (20-50 mesh), bags	8.75@10.00
(150-200 mesh), bags	9.75@12.50
Los Angeles, Calif.—Ground talc (200 mesh) (includ. bags)	16.00@20.00
Mertztown, Pa.—Ground talc (20-50 mesh); bulk, 5.00; bags	6.00
(150-200 mesh); bulk, 7.00; bags	8.00
Natural Bridge, N. Y.—Ground talc (150-200 mesh) bags	12.00@13.00
Rochester and East Granville, Vt.—Ground talc (20-50 mesh), bulk	8.50@10.00
(Bags extra)	
Ground talc (150-200 mesh), bulk	10.00@22.00
(Bags extra)	
Vermont—Ground talc (20-50 mesh); bags	7.50@10.00
Ground talc (150-200 mesh); bags	8.50@15.00
Waterbury, Vt. — Ground talc (20-50 mesh), bulk	7.50
(Bags 1.00 extra)	
Ground talc (150-200 mesh), bulk	9.00@14.00
(Bags 1.00 extra)	
Pencils and steel workers' crayons, per gross	1.20@ 2.00

Rock Phosphate

Raw Rock

Per 2240-lb. Ton

Centerville, Tenn—B.P.L. 72% to 75%	6.00@8.50
B.P.L. 65%	6.00
Gordonsburg, Tenn.—B.P.L. 68%-72%	4.50@5.00
Tennessee—F. o. b. mines, long tons, unground Tenn. brown rock, 72% B. P. L.	7.00
Mt. Pleasant, Tenn.—Analysis, .65-.70% B.P.L. (2000 lb.)	6.00@6.50
Paris, Idaho.—2000 lb. mine run, B.P.L. 70%	3.25

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Gray Roofing Slate, f. o. b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12	$10.20	$8.40	$8.10	$7.50
24x14	10.20	8.40	8.10	7.50
22x12	10.80	8.70	8.40	7.80
22x11	10.80	8.70	8.40	7.80
20x12	12.60	9.00	8.70	8.10
20x10	12.60	9.00	8.70	8.10
18x10	12.60	9.00	8.70	8.10
18x 9	12.60	9.00	8.70	8.10
16x10	12.60	8.70	8.40	7.80
16x 9	12.60	8.70	8.40	7.80
16x 8	12.60	8.70	8.40	7.80
18x12	12.60	9.00	8.70	8.10
16x12	12.60	8.70	8.40	7.80
14x10	11.10	8.40	8.10	7.50
14x 8	11.10	8.40	8.10	7.50
14x 7 to 12x6	9.30	8.10	7.50	7.50
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$8.10	$7.20	$5.75
22x11	8.40	8.40	7.50	5.75
Other sizes	8.70	8.70	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

(Continued from preceding page)

Ground Rock

Wales, Tenn.—B.P.L. 70%	7.75
Per 2000-lb. Ton	
Barton, Fla. — Analysis, 50% to 65% B.P.L.	3.50@8.00
Centerville, Tenn.—B.P.L., 60-65%	5.00@6.00
B.P.L. 75% (brown rock)	12.00
Columbia, Tenn.—B.P.L. 68% to 72%	5.50
B.P.L. 65% (90% thru 200 mesh) bulk	5.50
Montpelier, Idaho — Analysis, 72% B.P.L., crushed and dried	3.75
Mt. Pleasant, Tenn.—B.P.L. 65%	5.50
Twomey, Tenn.—B.P.L. 65%	6.50

Florida Soft Phosphate

Raw Land Pebble

	Per Ton
Florida—F. o. b. mines, long ton, 68/66% B.P.L.	3.00
68% (min.)	3.25
70% (min.)	3.50
Jacksonville (Fla.) District	10.00@12.00

Ground Land Pebble

	Per Ton
Jacksonville (Fla.) District	14.00
Add 2.50 for sacks.	
Morristown, Fla.—26% phos. acid	16.00
Mt. Pleasant, Tenn.—65-70% B.P.L.	5.00@ 6.00

Fluorspar

Fluorspar — 80% and over calcium fluoride, not over 5% silica; per ton f. o. b. Illinois and Kentucky mines	20.00
Fluorspar—85% and over calcium fluoride, not over 5% silica; per ton f. o. b. Illinois and Kentucky mines	21.50

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Chicago, Ill.—Stucco chips, in sacks f.o.b quarries		17.50
Deerfield, Md. — Green; bulk	7.00	7.00
Easton, Pa.—Evergreen, creme green and royal green marble	10.00@16.00	14.00@20.00
Slate granules		7.00@ 7.50
Granville, N. Y. — Red slate granules		7.50
Harrisburg, Va.—Black marble, bulk		12.50
Ingomar, Ohio	10.00@12.00	10.00@25.00
Milwaukee, Wis.		20.00@35.00
New York, N. Y.—Red and yellow Verona		32.00
Middlebrook, Mo.—Red		25.00@30.00
Phillipsb'g, N. J.—Green stucco dash	20.00@22.00	16.00@20.00
Poultney, Vt.—Slate granules		7.50
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Tuckahoe, N. Y.		5.00@12.00
Whitestone, Ga.—White marble chips, net ton in bulk, f.o.b., bags		
15c extra	4.50	4.50

Concrete Brick

Prices given per 1,000 brick, f. o. b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	20.00	25.00@35.00
Birmingham, Ala.	13.30	21.75
Carpenterville, N. J.	16.00	31.50@40.00
Easton, Pa.	16.00	40.00@60.00
Eugene, Ore.	25.00@26.00	50.00@75.00
Friesland, Wis.	23.00@24.00	30.00@35.00
Houston, Tex.		19.50
Omaha, Neb.	16.00	30.00@40.00
Portland, Ore. (Del'd)	21.00	45.00@60.00
Puyallup, Wash.	20.00	30.00@75.00
Rapid City, S. D.	18.00	25.00@40.00
St. Paul, Minn.	15.00	30.00@35.00
Salem, Ore.	25.00	35.00@50.00
Salt Lake City, Utah	17.00@18.00	35.00@40.00
Springfield, Ill.	18.00	29.00@25.00
Wauwatosa, Wis.	13.00@14.00	27.00@65.00
Watertown, N. Y.	18.00	35.00
Winnipeg, Can.	18.00	26.00

Sand-Lime Brick

Prices given per 1,000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	15.00
Buffalo, N. Y.	16.50
Dayton, Ohio	12.50@13.50
El Paso, Texas	13.00
Grand Rapids, Mich.	11.50
Lancaster, N. Y.	14.50
Michigan City, Ind.	11.00
Milwaukee, Wis. (delivered)	14.00
Minneapolis, Minn.	13.00
Plant City, Fla.	10.00
Redfield, Mass.	15.00
Rives Junction, Mich.	11.00
Saginaw, Mich.	11.00
San Antonio, Texas—Common	15.00
South Dayton, Ohio	12.50@13.50
Syracuse, N. Y. (delivered at job)	18.00
f.o.b. cars	16.00
Washington, D. C.	14.50

Lime

Warehouse prices, carload lots at principal cities.

	Hydrate per Ton Finishing	Common
Atlanta, Ga.	23.00	20.00
Baltimore, Md.	22.00	16.25
Cincinnati, Ohio	15.80	13.30
Chicago, Ill.	18.00	18.00
Dallas, Tex.	22.50	.....
Denver, Colo.	24.00	.....
Detroit, Mich.	19.50	17.50
Kansas City, Mo.	25.60	24.00
Minneapolis, Minn. (white)	25.50	21.00
Montreal, Que.	21.00	21.00
New Orleans, La.	.....	17.25
New York, N. Y.	16.80	13.10
Philadelphia, Pa.	15.50	14.50
St. Louis, Mo.	21.40	19.20
San Francisco, Calif.	22.00	16.00
Seattle, Wash. (paper sacks)	24.00	.....
	Lump per 180-lb. Barrel (net) Finishing	Common
Atlanta, Ga.	2.25†	1.85†
Cincinnati, Ohio	.....	10.75‡
Chicago, Ill.	1.50†	1.40†
Dallas, Tex.	.....	2.50†
Denver, Colo.	.....	2.70†
Detroit, Mich.	.....	18.25‡
Kansas City, Mo.	2.40†	2.40†
Minneapolis, Minn.	1.55†	1.40†
Montreal	15.00‡	11.00‡
New Orleans, La.	2.40†	.....
New York, N. Y.	3.75*	3.00@3.25*
Philadelphia, Pa.	13.00‡	12.00‡
St. Louis, Mo.	17.75	17.75‡
San Francisco, Calif.	.....	1.75†
Seattle, Wash.	2.80†	.....

*Per 280 lb. bbl. (net). †Per 180-lb. bbl. (net). ‡Per ton. Refund of 10c per bbl. Minneapolis quotes brown common lump lime: Kelly Island white is $1.55, Sheboygan $1.45. New York quotes hydrated lime "on cars" in paper sacks; lump lime "alongside dealers' docks" or "on cars."

Portland Cement

Current prices per barrel in carload lots, f. o. b. cars, without bags.

Atlanta, Ga.	2.80
Boston, Mass.	3.03
Cedar Rapids, Iowa	2.48
Cincinnati, Ohio	2.54
Cleveland, Ohio	2.46
Chicago, Ill.	2.20
Dallas, Tex.	2.25
Davenport, Iowa	2.43
Denver, Colo.	2.65
Detroit, Mich.	2.47
Duluth, Minn.	2.14
Indianapolis, Ind.	2.41
Kansas City, Mo.	2.45
Los Angeles, Calif.	3.00
Milwaukee, Wis.	2.37
Minneapolis, Minn.	2.39
Montreal, Can. (sacks 20c extra)	2.40
New Orleans, La.	2.83
New York, N. Y.	2.70
Phoenix, Ariz.	3.70
Pittsburgh, Pa.	2.24
Portland, Ore.	3.05
St. Louis, Mo.	2.35
St. Paul, Minn.	2.39
Toledo, Ohio	2.48
Seattle, Wash.	2.90

NOTE—Add 40c per bbl. for bags.

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco* Calcined Gypsum	Cement‡ and Gauging Plaster	Wood Fiber	White§ Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	——Plaster Board—— ⅜x32x36" Weight 1500 lb. Per M Sq. Ft.	⅜x32x36" Weight 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Douglas, Ariz.	.....	6.00	6.00	.....	13.00	.....	.....	.....	.....	.....	.....	.....	.....
Fort Dodge, Iowa	3.00	3.50	6.00	8.00	10.00	10.50	20.00	.....	21.30	20.00	20.00	.....	30.00
Garbutt, N. Y.	.....	.....	6.00	8.00	10.00	10.00	.....	7.00	.....	.....	.....	20.00	.....
Grand Rapids, Mich.	3.00	.....	5.00	10.00	10.00	10.00	.....	.....	31.00	.....	19.75	20.00	30.00
Hanover, Mont.	4.50	.....	6.00	10.00	.....	10.50	.....	.....	.....	.....	.....	.....	.....
Mound House, Nev.	.....	8.50	6.50	10.50@11.50	.....	.....	.....	.....	.....	.....	.....	.....	.....
Oakfield, N. Y.	3.00	4.00	6.00	8.00	10.00	10.00	20.20	7.00+	30.75	21.00	19.375	20.00	30.00
Rapid City, S. D.	4.00	.....	.....	10.00	12.00	12.50	.....	.....	33.75	.....	.....	.....	.....
Winnipeg, Man.	5.50	5.50	7.00	13.50	15.00	15.00	.....	.....	.....	.....	28.50	.....	35.00

NOTE—Returnable Jute Bags, 15c each, $3.00 per ton; Paper Bags, $1.00 per ton extra.
*Shipment in bulk 25c per ton less; ‡Bond plaster $1.50 per ton additional; +Sanded Wood Fiber $2.50 per ton additional; §White Moulding 50c per ton additional; ||Bulk; (a) Includes sacks.

News of All the Industry

Incorporations

The U. S. Potash Corp. has been incorporated at Wilmington, Del., for $250,000.

The Cajon Lime Products Co., Riverside, Cal., has been incorporated for $150,000.

The Dominion Portland Cement Co., Ltd., Montreal, Quebec, has been incorporated.

The Valley Rose Marble Co., Sweetwater, Texas, has been incorporated for $50,000.

The Genesee Sand and Gravel Corp., Buffalo, N. Y., has been incorporated for $100,000.

The Co-Operative Sand and Gravel Co., Los Angeles, Cal., has been incorporated for $100,000.

The White Concrete Products Co., 413 Market street, Camden, N. J., has been incorporated for $500,000.

The Ridely Phosphate Co., Nashville, Tenn., has been incorporated for $300,000, by G. W. Killebrow, Nashville, and others.

The Trusswall Stone Co., Wichita, Kans., has been incorporated for $50,000 by H. B. Gilkerson, H. E. Kinsey and B. F. Krebbiel.

The Albany Crushed Stone Corp., Albany, N. Y., has been incorporated for $300,000 by D. H. Craw, G. D. Kittredge and L. Murray.

The Northern Gravel and Rock Co., Ltd., Toronto, Ont., has been incorporated for $40,000 by L. G. Cook, T. K. Browne and others.

The Townsend Feldspar Co., Boothay Harbor, Maine, has been incorporated for $10,000 by G. W. Greenleaf, president; J. W. Brackett, treasurer.

The Harston Sand and Gravel Co., Dallas, Texas, has been incorporated for $120,000 by D. S. Harston, W. E. Callahan, J. H. Smith and others.

The French Mica Co., 208 Broad St., Elizabeth, N. J., has been incorporated for $10,000, by R. W. Leary, W. Clephane and D. McL. Somers.

The Rockaway Sand and Gravel Co., Inwood, N. Y., has been incorporated for $20,000 by F. D. Licurse, A. Sourachie, Inwood, and F. Lavelle, Far Rockaway.

The Enterprise Lime and Ballast Co., Cumberland, Md., has been incorporated for $100,000 by C. E. Schaidt, W. J. Shannon and W. M. Somerville.

The New River Sand and Gravel Co., Huntington, W. Va., has been incorporated for $50,000 by A. Irwin, F. Pike, Huntington; J. E. Armstrong, T. Burgess, Barboursville; and R. J. Thrift, Charleston.

The Great Lakes Trap Rock Co., Ltd., has been incorporated for $200,000 by H. H. Sherman, I. Appleton, Sault Ste. Marie, Mich.; J. S. Bincomb, Sault Ste. Marie, Ont., and others. The office will be at Sault Ste. Marie, Ont.

Sand and Gravel

The Shepherd Sand and Gravel Co., Shepherd, Tenn., has increased its capital stock to $40,000.

The Hugger Brothers Gravel Co., Montgomery, Ala., has changed its name to the Alabama Sand and Gravel Co.

The Louisiana Sand and Gravel Co., Monroe, La., will operate a new gravel bed near Boscoe and erect a plant and dredging machinery to cost $30,000.

The Monroe Sand and Gravel Co., Monroe, La., has increased its capital stock to $125,000. The company will make extensive improvements at its operation.

Oyster Bay, N. Y.—The Turner Construction Co., New York, has purchased the Dodge farm for $140,000 and will erect a sand and gravel plant on the property.

Wheeling, W. Va.—The new sand and gravel plant of the Independent River Sand Co. is nearing completion and will shortly be in operation. It is one of the most modern on the Ohio river and was built under the supervision of N. M. Thomas, Parkersburg.

Memphis, Tenn.—The Missouri Portland Cement Co. reports that winter trade holds up well. It is getting its product by rail and not using boats as formerly. The loading and unloading station in North Memphis, along the Wolf river, is being greatly enlarged.

Lime

The O'Neals Lime Works has moved its general offices from Birmingham, Ala., to the plant at Eureka, Ala.

The Luckey Lime and Supply Co., Luckey, Ohio, has elected C. C. Martin president; F. W. Williams, Jr., vice-president; L. B. Martin, secretary; H. A. Niceman, treasurer.

Hagerstown, Md.—The Potomac Valley Stone and Lime Co. has sold to the Keystone Lime Co. about 165 acres, near Pinesburg. The land contains stone of high lime content. The consideration was around $60,000.

The Fisher Lime and Cement Co., Memphis, Tenn., with branches in Little Rock and Greenville, Miss., and quarries at Williford, Ark., report good January activities. A new warehouse covering a block has been completed.

Waco, Texas—The Koury Calcium Co., near Waco, has been reorganized and plans to begin operations. A hydrating plant will be installed, in addition to a high power stone crusher. B. F. Litsinger, president; C. P. Shaffer and J. P. Philps, vice-presidents, and W. V. Hanover, secretary-treasurer. The company will have offices at Waco.

The Kawah Lime Products Co., near Woodlake, Calif., has just completed the installation of machinery and buildings to increase its capacity from 30,000 to 60,000 tons per year. The plant is electrically equipped, costing about $7000. The plant now has five large pulverizing mills in operation, two large crushers, an air compressor and modern machinery; $26,000 has been spent for these improvements. A. C. Root, Fresno, is president.

Personal

W. A. Titus, state senator, has been re-elected president and treasurer of the Standard Lime and Stone Co., Fond Du Lac, Wis.

G. A. Begeman, formerly president of the Mississippi Sand and Gravel Co., Burlington, Ia., has resigned. He will be succeeded by L. A. Miller as president.

Harry W. Tupman, Jr., formerly with the Portland Cement Association, is now connected with the Besser Sales Co., at 53 West Jackson boulevard, Chicago.

H. M. Loveland, Hudson, N. Y., has assumed the duties of superintendent at the Bonner Springs cement plant, recently purchased by the International Cement Corp.

William B. Hargrave, for eight years connected with the Standard Brick Co., Crawfordsville, Ind., has accepted a position with the Nicholson Corp., Kansas City, Mo., owners and operators of brick plants, cement mills, iron and zinc mines.

Andrew Hamilton, of Hamilton and Shreve, consulting engineers, Fayetteville, Ark., has accepted a position as district manager with the National Lime Association, with headquarters at Dallas, Texas, and will assume his duties March 1. He will have charge of the territory of Arkansas, Oklahoma, Louisiana and Texas.

Frank H. Williams, New York State engineer, retired from office January 1, after serving five terms, and will open an office in Albany, N. Y., and engage in a general consulting engineering practice. He is associated with the Technical Advisory Corp., New York, and is to become actively interested in the Norton Stone and Lime Corp., Cobleskill, N. Y., of which he is vice-president.

Edgar C. Welborn and William Chapin Huntington announce the formation of a partnership to extend the work heretofore carried on under the name E. C. Welborn. They will continue to make business surveys of industrial enterprises, getting the actual facts underlying the production and marketing of any commodity, and will assemble the experience and opinions of producers, distributors and consumers in the industry under investigation. Special facilities are available for the investigation of foreign as well as domestic markets and industries.

Manufacturers

Sauerman Bros., Chicago, Ill., manufacturers of dragline cableways, power scrapers, etc., announce the removal of its offices from the Monadnock block, where it has been located for 17 years, to 438 South Clinton street. The company's shop, warehouse and assembly room have been located there for some time, and with all departments under one roof the company assures better service.

The Morse Chain Co., Ithaca, N. Y., is now operating in its new Detroit plant, the increased demand for its products having necessitated increased manufacturing facilities. The company established a branch factory in Detroit three years ago, as industrial conditions in Ithaca did not warrant expansion in that city. The new plant is a one-story, concrete and steel building with 60,000 sq. ft. of floor space. A year ago, the company acquired a five-acre tract on West Warren avenue on the Detroit Terminal Railway and it is in a position to expand its plant as demands increase. The company specializes in chain drives for industrial transmissions and perfected the application of silent chains to cam and accessory drives in automobile engines. The Detroit plant will manufacture all sprockets and adjustments used in Morse front end drives and the new Morse silent chain bus transmission.

Trade Literature

Grinding and Pulverizing—The Hardinge Co., New York, has published a bulletin on grinding and pulverizing in the Hardinge conical mill. This bulletin takes up the principles of grinding and how these principles apply to any class of material, whether this grinding is to be wet or dry, or whether the product desired is to be as granular as possible or extremely fine and uniform in texture. The bulletin also describes the new type of conical mill, both in large and small operations.

Speed Reducer—The W. A. Jones Foundry and Machine Co., Chicago, announces the publication of its new catalog No. 26, covering the Jones spur gear speed reducer. This is a new edition and the information contained is intended particularly to be of value to consulting engineers, superintendents, chief engineers and master mechanics, or anyone who specifies mechanical drives for factories, mills, mines or plants. The edition embodies technical and practical information, complete descriptive matter and illustrations of drives. The installation section presents, pictorially, reduced drives in many large industrial plants. Dimensions, rates and horsepower ratings for complete speed reduction sets are shown. The company intends making this book a standard work and placing copies in the hands of all interested in speed reduction problems.

The American Spiral Pipe Works, Chicago, announces its new spiral riveted pipe catalog No. 22-20. The initial pages are devoted to a short description of the method of producing Taylor's spiral riveted pipe. The succeeding pages photographically feature many of the most notable installations of the past two decades and conveniently visualize the best practice in pipe line construction to meet the most varied conditions. The catalog is so constructed mechanically that one may instantly turn to price lists which have been grouped in the most logical order—a point which will be much appreciated by the busy man. Several pages have been devoted exclusively to an excellent collection of valuable hydraulic tables and charts. The major portion has been devoted to an old established line of Taylor's spiral riveted pipe, in which the company has specialized for more than 25 years. An added feature is a brief reference to some more recently developed lines, such as types of forged steel flanges, large diameter forge welded pipe, corrugated steel furnaces, etc.

Buyers' Directory
of the Rock Products Industry

Classified Directory of Advertisers in this issue of Rock Products

AERIAL TRAMWAYS
Interstate Equip. Co., New York, N. Y.

AUTOMATIC WEIGHERS
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

BAGS AND BAG MACHINERY
Jaite Co., The, Jaite, Ohio.

BARRELS—Lime
Draper Mfg. Co., The, Cleveland, Ohio.

BELTING
Greenville Mfg. Co., Greenville, Ohio.
New York Belting and Packing Co., New York City.
Robins Conveying Belt Co., New York City, N. Y.

BINS
Link-Belt Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill. (storage)

BIN GATES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bacon, Earle C., Inc., New York City.
Greenville Mfg. Co., Greenville, Ohio.
Link-Belt Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

BLASTING SUPPLIES
Atlas Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio.

BUCKETS—Elevator
Greenville Mfg. Co., Greenville, Ohio.
Hendrick Mfg. Co., Carbondale, Pa.
Link-Belt Co., Chicago, Ill.
Orton & Steinbrenner, Chicago, Ill.
Webster Mfg. Co., The, Chicago, Ill.

BUCKETS
McMyler Interstate Co., Cleveland, Ohio.

CABLEWAYS
Interstate Equip. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.

CALCINING MACHINERY
Ehrsam & Sons Co., J. B., Enterprise, Kans.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.

CARS—Quarry and Industrial
Koppel Industrial Car and Equipment Co., Koppel, Pa.
Watt Mining Car Wheel Co., Barnesville, Ohio.

CAR PULLERS
Link-Belt Co., Chicago, Ill.
Mining Machine Co., Mountville, Pa.
Weller Mfg. Co., Chicago, Ill.

CEMENT MACHINERY
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CHAIN
Carroll Chain Co., The, Columbus, Ohio.
Morse Chain Co., Ithaca, N. Y.

CONVEYORS AND ELEVATORS
Caldwell, H. W., & Son Co., Chicago, Ill.
Greenville Mfg. Co., Greenville, Ohio.
Link-Belt Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.
Robins Conveying Belt Co., New York City.
Sturtevant Mill Co., Boston, Mass.
W. Toepfer & Sons Co., Milwaukee, Wis.
Universal Road Mach. Co., Kingston, N. Y.
Webster Mfg. Co., The, Chicago, Ill.

CRANES—Crawling Tractor
Industrial Works, Bay City, Mich.

CRANES—Locomotive, Gantry
Byers Mach. Co., The, Ravenna, Ohio.
Erie Steam Shovel Co., Erie, Pa.
Industrial Works, Bay City, Mich.
Koehring Co., Milwaukee, Wis.
Link-Belt Co., Chicago, Ill.
McMyler-Interstate Co., Cleveland, Ohio.
Ohio Locomotive Crane Co., Bucyrus, Ohio.
Orton & Steinbrenner, Chicago, Ill.
Osgood Co., The, Marion, Ohio.

CRUSHERS AND PULVERIZERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulverizer Co., St. Louis, Mo.
Austin Mfg. Co., Chicago, Ill.
Bacon, Earle C., Inc., New York, N. Y.
Buchanan Co, Inc., C. G., New York, N. Y.
Ehrsam & Sons Co. J. B., Enterprise, Kan.
Good Roads Machinery Co., Kennett Square, Pa.
K. B. Pulverizer Co., New York, N. Y.
Lewistown Fdry. & Mach. Co., Lewistown, Pa.
McLanahan-Stone Mach. Co., Hollidaysburg, Pa.
Morgan Engineering Co., The Alliance, Ohio.
New Holland Machine Co., New Holland, Pa.
Pennsylvania Crusher Co., Philadelphia, Pa.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Smidth & Co., F. L., New York, N. Y.
Smith Eng Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Universal Crusher Co., Cedar Rapids, Iowa.
Universal Road Mach. Co., Kingston, N. Y.
Webb City & Carterville Fdy. and Mach. Wks., Webb City, Mo.

CRUSHER REPAIRS—Manganese Steel
American Manganese Steel Co., Chicago Heights, Ill.
Taylor Wharton Iron & Steel Co., High Bridge, N. J.

CLUTCHES
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

DERRICKS
American Hoist & Derrick Co., St. Paul, Minn.

DIPPER TEETH
American Manganese Steel Co., Chicago Heights, Ill.

DRILLS
Armstrong Mfg. Co., Waterloo, Iowa.
Sanderson Cyclone Drill Co., Orrville, Ohio.

DRYERS
American Process Co., New York City.
Vulcan Iron Works, Wilkes-Barre, Pa.
Weller Mfg. Co., Chicago, Ill.

DUST COLLECTING SYSTEMS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

DYNAMITE
Atlas Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio.

ENGINES—Steam
Morris Mach. Works, Baldwinsville, N. Y.

ENGINES—Oil
Kahlenberg Bros. Co., Two Rivers, Wis.
Power Mfg. Co., Marion, Ohio.

ENGINEERS
Bacon, Earle C., Inc., New York, N. Y.
Ehrsam & Sons Co., J. B., Enterprise, Kans.
R. W. Hunt & Co., Chicago, Ill.
Smidth & Co., F. L., New York, N. Y.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
Webster Mfg. Co., The, Chicago, Ill.

EXCAVATORS
Erie Steam Shovel Co., Erie, Pa.
Koehring Co., Milwaukee, Wis.
Northwest Engineering Co., Chicago, Ill.

EXCAVATORS—Dragline Cableway
Link-Belt Co., Chicago, Ill.
Northwest Engineering Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.

EXPLOSIVES
Atlas Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio.

FUSES
Ensign-Bickford Co., Simsbury, Conn.

GAS PRODUCERS
Morgan Construction Co., Worcester, Mass.

GEARS
Caldwell, H. W., & Son Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Link-Belt Co., Chicago, Ill.

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GENERATORS
Burke Electric Co., Erie, Pa.

GREASE
Keystone Lubricating Co. The, Philadelphia, Pa.

GRIZZLIES
Robins Conveying Belt Co., N. Y. City, N. Y.

HOISTS
American Hoist & Derrick Co., St. Paul, Minn.
J. S. Mundy Hoisting Engine Co., Newark, N. J.
Link-Belt Co., Chicago, Ill.
Thomas Elevator Co., Chicago, Ill.
Vulcan Iron Works, Wilkes-Barre, Pa.
Weller Mfg. Co., Chicago, Ill.

HOSE—Water, Steam, Air Drill, Pneumatic Tool
New York Belting and Packing Co., New York City.
Robins Conveying Belt Co., New York City, N. Y.

HYDRATING MACHINERY
Kritzer Co., The, Chicago, Ill.
Miscampbell, H., Duluth, Minn.
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.
W. Toepfer & Sons Co., Milwaukee, Wis.

HYDRAULIC DREDGES
Morris Machine Works, Baldwinsville, N. Y.

INSULATION—Heat
Celite Products Co., Chicago, Ill.

LIME HANDLING EQUIPMENT
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

LIME KILNS
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Vulcan Iron Works, Wilkes-Barre, Pa.

LOADERS AND UNLOADERS
Erie Steam Shovel Co., Erie, Pa.
Link-Belt Co., Chicago, Ill.
Orton & Steinbrenner, Chicago, Ill.

LOCOMOTIVES
Baldwin Locomotive Works, The, Philadelphia, Pa.
Fate-Root-Heath Co., Plymouth, Ohio.
Hadfield-Penfield Steel Co., Bucyrus, Ohio.
Ironton Engine Co., Ironton, Ohio.
Lima Locomotive Works, New York, N. Y.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Co., Geo. D., Rochelle, Ill.

LUBRICANTS
Keystone Lubricating Co. The, Philadelphia, Pa.

MOTORS, ELECTRIC
Burke Electric Co., Erie, Pa.

MOTOR TRUCKS
Traylor Eng. & Mfg. Co., Allentown, Pa.

PERFORATED METALS
Cross Eng. Co., Carbondale, Pa.
Harrington & King Perforating Co., The, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PLASTER MACHINERY
Ehrsam & Sons Co., J. B., Enterprise, Kans.

PORTABLE CONVEYORS
Link-Belt Co., Chicago, Ill.

POWDER
Atlas Powder Co., Wilmington, Del.
Grasselli Powder Co., Cleveland, Ohio.

POWER TRANSMITTING MACHINERY
Caldwell, H. W., & Son Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., The, Chicago, Ill.

PULLEYS
Link-Belt Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

PULVERIZED FUEL EQUIPMENT
Raymond Bros. Impact Pulv. Co., Chicago, Ill.

PUMPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Heights, Ill.
Evinrude Motor Co., Milwaukee, Wis.
Morris Machine Works, Baldwinsville, N. Y.
Traylor Eng. & Mfg. Co., Allentown, Pa.

PUMP VALVES
New York Belting and Packing Co., New York City.

QUARRY EQUIPMENT
Universal Road Mach. Co., Kingston, N. Y.

REGULATORS
Chowning Regulator Corp., Corning, N. Y.

ROAD MACHINERY
Austin-Western Road Machy. Co., Chicago, Ill.

ROPE, WIRE
Leschen, A., & Sons Co., St. Louis, Mo.

SCRAPERS, DRAG
Link-Belt Co., Chicago, Ill.
Sauerman Bros., Chicago, Ill.

SCREENS
Cross Eng. Co., Carbondale, Pa.
Greenville Mfg. Co., Greenville, Ohio.
Harrington & King Perforating Co., The, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Link-Belt Co., Chicago, Ill.
Orville Simpson Co., Cincinnati, Ohio.
Smith Eng. Works, Milwaukee, Wis.
Sturtevant Mill Co., Boston, Mass.
W. Toepfer & Sons Co., Milwaukee, Wis.
Traylor Eng. & Mfg. Co., Allentown, Pa.
Tyler Co., The, W. S., Cleveland, Ohio.
Universal Road Mach. Co., Kingston, N. Y.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

SEPARATORS
Rubert M. Gay Co., New York City.
Raymond Bros. Impact Pulv. Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.
Tyler Co., The W. S., Cleveland, Ohio.

SEPARATORS, MAGNETIC
Buchanan Co., C. G., Inc., New York, N. Y.

SHEAVES
Link-Belt Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

SHOVELS—Steam and Electric
Bucyrus Co., South Milwaukee, Wis.
Erie Steam Shovel Co., Erie, Pa.
Hoar Shovel Co., Duluth, Minn.
Marion Steam Shovel Co., Marion, Ohio
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Osgood Co., The, Marion, Ohio.

SPROCKETS
Link-Belt Co., Chicago, Ill.
Webster Mfg. Co., The, Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

STEEL PLATE CONSTRUCTION
Hendrick Mfg. Co., Carbondale, Pa.

STUCCO FACINGS
Metro-Nite Co., Milwaukee, Wis.
Vermont Milling Prod. Co., Fair Haven, Vt.

TANKS, STEEL STORAGE
Traylor Eng. & Mfg. Co., Allentown, Pa.

TESTING SIEVES AND TESTING SIEVE SHAKERS
Tyler Co., The W. S., Cleveland, Ohio.

TRAMWAYS
Interstate Equip. Co., New York, N. Y.

TRANSFORMERS
Burke Electric Co., Erie, Pa.

TRANSMISSION MACHINERY
Link-Belt Co., Chicago, Ill.
Weller Mfg. Co., Chicago, Ill.

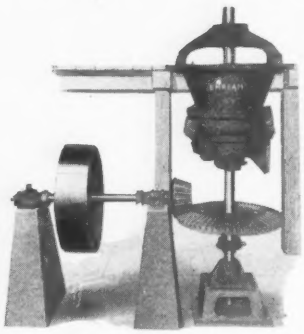
WASHERS, SAND AND GRAVEL
Greenville Mfg. Co., Greenville, Ohio.
Link Belt Co., Chicago, Ill.
Smith Eng. Works, Milwaukee, Wis.

WELDING EQUIPMENT
Burke Electric Co., Erie, Pa.

WIRE ROPE
Leschen, A., & Sons Co., St. Louis, Mo.

WIRE CLOTH
Cleveland Wire Cloth Co., Cleveland, Ohio.
Tyler Co., The W. S., Cleveland, Ohio.

EHRSAM
Rotary Crushers



These crushers are furnished in four sizes. Top diameter of bowls: 20-in., 28-in., 36-in., and 42-in., with capacities of from 5 to 60 tons per hour.

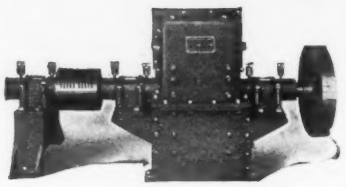
Ehrsam Rotary Crushers insure uninterrupted service. They are Ehrsam products correctly designed and constructed for efficiency and economy.

Our Gypsum Plaster Mill Machinery

Hair and Fiber Pickers
Elevating and Conveying Machinery
Hammer and Revolving Screens
Power Transmission Machinery
Jaw Crushers
Fine Grinding Mills
Calcining Kettles
Mixers

The J. B. Ehrsam & Sons Mfg. Company
Enterprise, Kansas

"K-B" ALL-STEEL PULVERIZER



High Production
Low Power Cost

The efficiency of any machine lies in its ability to do a large amount of work with a small consumption of power.

The "K-B" does this!

Ask us for full information

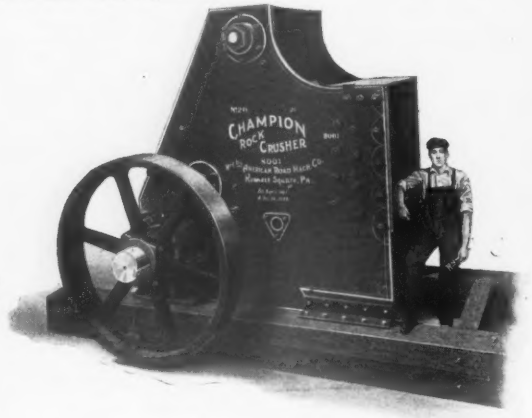
K-B PULVERIZER

K-B Pulverizer Company, Inc.
92 Lafayette Street, New York

Thirty Two Years Ago

The First Champion Crusher Was Built

Since that time more than 6,000 crushers have been sold and users are to be found in every country in the world. The Champion is a slow speed, steel frame crusher, with a large capacity and low upkeep cost. Made in many sizes from 50 to 1000 tons' daily capacities.

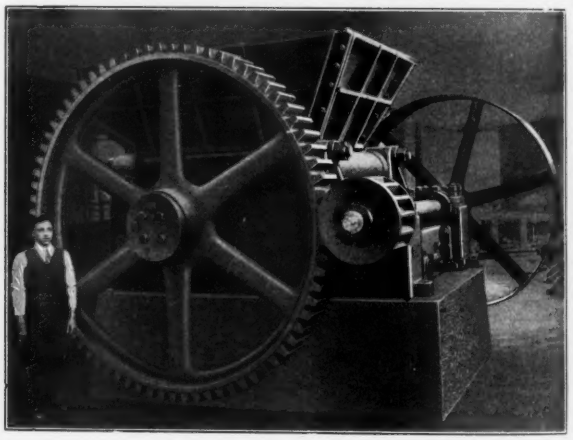


No. 20 (22 by 50) Champion Steel Rock Crusher

We design, build and install complete crushing outfits of any size desired. We specialize in the building of Elevators, Screens, and Conveyors of any desired capacity.

Ask for catalogue, "Champion Crushing and Quarrying Machinery." It is free.

THE GOOD ROADS MACHINERY CO., INC.
1203 Tower Building, Chicago, Ill.
Kennett Square, Pa.



If you had seen the McLanahan Single Roll Crusher before ordering your first Gyratory or Jaw Crusher, you would now be running only the McLanahan Crushers.

After many years' practical experience building and operating other crushers, we brought out the first Single Roll Crusher, proved it best, simplest and most economical—making least fines—requires but little head room—no apron or hand feeding—takes wet or slimy material.

Capacity, 5 to 500 Tons Per Hour

McLanahan-Stone Machine Co.
Hollidaysburg, Pa.
Screens, Elevators, Conveyors, Rock Washers, Etc.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid for in advance of insertion.

CRUSHERS

1—60x84 P. & M. Jaw
1—24x48 Buchanan Jaw
1—10x16 Farrell Jaw
1—No. 8K Gates Gyratory
1—No. 6K Gates Gyratory
5—No. 5K Gates Gyratory
1—No. 3D Gates Gyratory

T. H. Letson Co.
46 Church Street **New York**

For Sale by Owners

Quarry equipment, consisting of standard gauge locomotives, steam shovel, quarry cars, crushers, well drills, rails, ties, etc.

Box 1625, care of Rock Products
542 South Dearborn Street, Chicago

SPECIAL BARGAINS

Send Us Your Boiler Inquiries

66x86-in. TRAYLOR JAW CRUSHER
No. 18K GATES CRUSHER
25, 50, 80, 110-hp. Electric Hoists
Nos. 4-5-6-7½-9-10 CRUSHERS
6 and 12-ton Gasoline Locomotives
2 Disc Crushers, 36 and 24-in. Symons
100-ton 2½-yd. Electric Shovel
50-5000-ft. Steam, Belt and Electric Comp's
13x30-in., 10x18-in., 9x14-in. Jaw Crushers
24x54 McLanahan Roll Crusher
NEW 35-25-Kw. G.E. 125-V. Steam Turbo Sets
NEW G.E. Gasoline Engine Sets, 5-25 Kw.
NEW 1000-Gpm. Cent. Pump. Elec. Drive
1000-Gpm. Underwriters' Steam Pump

Send us inquiries for your wants

ROSS POWER EQUIPMENT CO.
Indianapolis, Ind.

FOR SALE

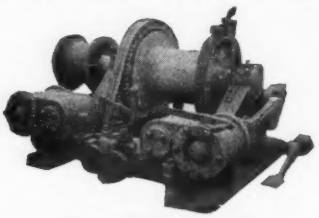
No. 3 Austin Gyratory Crusher complete.
2 No. 2 Climax 9"x16" Jaw Crushers complete.
1800 ft. No. 4 d.b. and w.p. electric wire.
50' Cont. bucket and chain elevator, buckets 8"x16".
75 H.P. 13"x16" side crank Erie City Steam Engine.
9"x14" Vulcan Locomotive No. 981 complete.
2 G.E. 150 H.P. Induction Motors, voltage 220-440, shop numbers 625140 and 1164925—complete with starters.
Williams No. 9 Universal type swing hammer pulverizer complete.
Kent three-roller pulverizer.
10"x8"x20" Worthington St'm Pump No. 16876.
Sanderson Cyclone No. 14 well drill, either electric or gasoline driven, complete.
Austin Standard Revolving Screen 40" diam. by 20' long, complete.

E. W. COOPER, Engineer
174 3rd Ave. North **Nashville, Tenn.**

FOR SALE

BARGAIN

Emerson, Bratingham Hoists
UNUSED
DOUBLE CYLINDER, SINGLE DRUM, IN FIRST CONDITION
$125.00 Each F.O.B. Chicago



Capacity 10,000 Pounds
IMMEDIATE SHIPMENT
Detailed Specifications Furnished on Application
"QUANTITY IS LIMITED"

Hyman-Michaels Co.
531 Peoples Gas Bldg., Chicago, Ill.

FOR SALE

1—Steam Fire Pump—Underwriters' specifications, 18x10x12-in. Capacity 1000 gallons per minute on four 1⅛-in. smooth nozzles at 70 r.p.m. Type 216420-B. No. 537049-W. Price, $500.
1—120 K. W. generator, A. C. current, 440 volt, 3 phase, 60 cycle, 157.5 amperes per terminal, 900 r.p.m. Serial No. 607964 Westinghouse. Price, $2,000.
2—Sirocco fans made by American Blower Company. No. 80-B and 8379-B. Price, $200 each.
1—Pangborn Sand Blast Machine. Standard pressure system. Type A. C., size No. 6. Serial No. 131837. Price, $300.
1—7x100 Vulcan kiln complete with tires, trunnions, cradles, hood, etc. Price, $5,000.
4—Tires for 8-in. kiln. Price, $100 each.
1—W7 Penna. Hammer Mill. Price, $750.
1—Buchanan Roll, 24x15. Price, $350.
1—No. 3 Sturtevant Fan. Price, $25.
1—No. 5 Sturtevant Fan. Price, $250.

Security Cement and Lime Co.
Hagerstown, Maryland

FOR SALE

2—8x110' Rotary Kilns.
5—5x6x7x110' Rotary Kilns.
5—5x21' Tube Mills (1 has Silax lining, 3 steel lining, 1 without lining).
1—4' 6"x29' Coal Dryer.
2—No. 6 Gates Crushers.
3—5½x22' Tube Mills.
2—6x50' Rotary Dryers.
3—Kominuters.
6—Krupp Ball Mills.
3—33" Fuller Mills.
2—6x60' Rotary Dryers.

ENGINEERING SALES COMPANY, Nashville, Tenn.
OLLIE LAWRENCE, Stockertown, Pa.

IMMEDIATE DELIVERY

1—7½x13-in. Champion Jaw Crusher; excellent condition $300.00
7—1¼ yd. end dump wood quarry cars, 30-in. gauge 85.00
Trucks alone worth this money
1—12x16-in. Chandler Taylor Steam Engine, side crank left hand, self contained, slide valve; 17x72-in. band flywheel, shop No. 6070; excellent condition 350.00

CERULEAN STONE COMPANY
Cerulean, Trigg County, Ky.

WANTED

A 1½ Sturtevant Open Door Crusher in first class condition. State length of time used and exact condition.

Cheney Lime Company
Allgood, Ala.

FOR SALE

One No. 5, No. 8 Kennedy Crushers, 12x20 Buchanan. Four sections 60-in. diameter screen, 4 segments to the section, 3½-in. perforation, extra heavy manganese. Address

BALD MOUNTAIN QUARRIES, Inc.
Newsom, N. C.

WANTED

3-ton Plymouth Locomotive, 36-in. gage. 6 to 10 "V" type body Rocker Dump Cars with brakes, 36 to 42-in. gage. Address

Box 1622, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

Used Equipment

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid in advance of insertion

2—50-ton standard gauge Baldwin 6-wheel switchers, built 1913.
1—42-ton standard gauge Heisler geared locomotive, built 1910.
1—42-ton standard gauge Shay geared locomotive.
1—12x18" standard gauge 4-wheel saddle tank.
1—23-ton new 36" gauge Porter 6-wheeler with separate tender.
10—5-ton 36" gauge storage battery locomotives.
1—14-B Bucyrus steam shovel, mounted on traction wheels.

Birmingham Rail and Locomotive Co.
Birmingham, Alabama

ROTARY DRYERS

30 New Direct Fired Rotary Dryers, 4 ft. — in. diameter, 30 ft. long

These Dryers were about to be put into operation as the armistice was signed, and consequently were never used. We are offering them at a sacrifice, complete with driving mechanism, furnace iron, grates, etc. Some are equipped with steam radiators for steam heated air drying.

McDERMOTT BROS. CO.
Allentown, Penna.

For Sale at a Bargain

Six Used Kent Mills
Five Used Maxecon Mills

For quick disposal. Will sacrifice Kent Mills for $350 each and Maxecon Mills at $500 each. Two of the Maxecon Mills bought new in 1917 and one bought new in 1920. All mills can be inspected at La Salle, Ill.

Marquette Cement Manufacturing Company
La Salle, Ill.

WANTED

Raymond No. 5 High Side Roller Pulverizer with or without Air Separating System if in good condition. Address

Palmer Lime and Cement Company
103 Park Avenue, New York

Machinery For Sale

DRYERS—Direct-heat rotary dryers, 3x25', 3½x25', 4x30', 5½x50', 6x60' and 7x60'; double shell dryers, 4x20', 5x30' and 6x35'; steam-heated air rotary dryers, 4x30' and 6x30'.

KILNS—Rotary kilns, 4x40', 5x50' and 6x70', 6x100', 7x80' and 8x110'.

MILLS—6x8', 6x5', 5x4', 3x3½' pebble and ball mills; 3' March mill; 42", 33" and 24" Fuller-Lehigh mills; 4½x20', 5x11', 5x20', 5½x22' and 6x20' tube mills; 7½x13", 9x15", 16x10" and 12x26" jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 24", 36" and 40" cage mills; 3' and 4½', 6' and 8' Hardinge mills; 18x12", 20x12" and 30x10" roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 5 roll and 2 roll No. 1 and No. 000, No. 00 and No. 0 Raymond mills; one No. 3 and No. 4 and No. 7½ Telsmith breaker; one 36" Sturtevant emery mill; one 3 roll Griffin mill; 60" chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; 6x8', 6x5' and 4x3' Newaygo vibrating screens; Richardson automatic scales; 8' and 10' Emerick air separators.

Air compressors.

W. P. Heineken, Engineer
95 Liberty Street, New York. Tel. Cortland 1841

FOR RENT AND SALE

1—Class 14 Bucyrus dragline on caterpillars, 70-ft. boom, 2-yd. bucket, built in 1921.
1—Osgood 18 revolving shovel, traction wheels, No. 794, ¾-yd. bucket, built 1920.
1—Western std. gauge spreader, used 60 days.
50—60,000-lb. capacity flat and box cars.
2—Foote 40-S 1-yd. side discharge concrete mixers, with steam engine and boiler.
14—NEW 20-in. I-beams, 80 lbs. per, 40 ft. long, not drilled.
1—NEW Lakewood concrete chuting system.

LOCOMOTIVES

3—20-ton 11x16" four-driver saddle-tank standard gauge Americans, built 1912.
1—50-ton 18x24-in. six-wheel switcher.
1—40-ton 17x24-in. four-wheel switcher.
2—NEW 24-ton six-wheel Porters, separate tender, 36-in. gauge.
2—18, 14 and 10-ton Vulcans, 36-in. gauge.

Industrial Equipment Co.
McCormick Building, Chicago, Ill.

Mine Cars, Rails and Ties

We have mine cars in stock for all purposes. Also rails 12 lb. to 100 lb. section. Spikes, bolts, frogs and switches. All trade is solicited and prices cheerfully quoted.

M. K. FRANK
Frick Building Pittsburgh, Pa.

IMMEDIATE SHIPMENT

2—Austin No. 3 Gyratory Crushers.
2—Bonnot 5'x22' Compeb (tube) Mills.
1—Vulcan 8'x120' Rotary Kiln.
1—Renneberg 5½'x45' Ore Dryer.
4—American Process 4'x30' Rotary Dryers.
1—Link Belt 20-Ton Hourly Coal Crusher.
2—Hardinge 8' Conical Mills.
Raymond, Kent and Fuller Mills.
Swing Hammer Mills, all makes.
Buchanan and Sturtevant Crushing Rolls.
Jaw, Gyratory and Disc Crushers.
Complete Experimental Cement Plant.

High Grade Used Machinery for the Entire Rock Products and Non-Metallic Industry Our Specialty

American Machinery Equipment Co., P. O. Box No. 292, Charlotte, N. C.

FOR SALE

4—No. 11 ½ yard Cube Mixers with Boilers and Engines.
3—No. 17 ½ yard Cube Mixers with Boilers and Engines.
2—6" Cent. Pumps, with Engines.
1—4" Cent. Pump, with Engines.
1—No. 3 Marsh Capron Rail Track Mixer with Engine.
1—15 ton, 4 wheel Locomotive Crane—38 ft. boom.
1—Seaverns Hoist.
1—Seaverns Transfer Car.
1—6"x6" Duplex Gardner Governor Air Compressor.

Superior Stone Company
5 North LaSalle St. Chicago, Ill.

For Sale—STEAM SHOVEL

⅝ YD. THEW "O" TRACTION

Thoroughly rebuilt; attractive terms for quick sale.

Walter A. Zelnicker Supply Co., St. Louis
Rails, Locomotives, Cars, Tanks, Pipe

DREDGE FOR SALE

Fully equipped steam suction dredge ready for immediate service.

8-in. Morris direct connected pump.

Dull inclined conical screens.

Separate sand sluice so that straight sand can be pumped without elevating to sand and gravel separating rig.

Hull built of full length Oregon fir.

H. H. Halliday Sand Co.
Cairo, Ill.

WANTED

Shaft, or Shaft and Head for 7½ Gates Crusher, B or D style.

MASSACHUSETTS BROKEN STONE COMPANY
Stony Brook Massachusetts

Classified Advertising

Rates for advertising in the Used Equipment Department: $2.50 per column inch per insertion. Minimum charge, $2.50. Please send check with your order. These ads must be paid for in advance of insertion.

For Sale or Lease

A small, modern equipped crushing and pulverizing plant, quarry consisting of about 50 acres underlaid with a high quality Clinton strata blue limestone, 30 x 500 ft. open face dry quarry; 94.20 carbonate state test; makes an extra strong burned lime; big local demand. Plant in operation; a fine location for a larger plant. Plant near Lynchburg, Ohio. Call on or address

FRANK SHARP
Lynchburg, Ohio

FOR SALE

An Interest in Crushed Limestone Quarry in Eastern Iowa

This is a splendid opportunity for a capable man with knowledge of the business and some capital to make big money.

For further facts address

Box 1620, care Rock Products,
542 South Dearborn Street, Chicago, Ill.

Will Sell My Two Phosphate Plants

One plant in operation. Cost of plants $125,000. Equipped for mining hard and soft phosphate; 50 to 75 tons per day each; 125 miles from Jacksonville, located in the high grade hard rock phosphate belt. Analysis 76 to 82 B. P. L. I. and A. 2 to 3. Estimated over 300,000 tons of hard rock. One-half million tons of soft rock. Analysis, phosphoric acid, 24 to 32. Five hundred acres of land together with dwelling houses, phosphate bins and all other necessary buildings for laborers. One-quarter mile R. R. side track to each plant from A. C. L. R. R., main line. Will take fifty cents on the dollar for its actual value. $50,000 cash will secure the property, balance of payments, reasonable terms, or royalty basis. For further information, if interested, write me, the owner,

J. Frank Meredith
Dunnellon, Fla.

Take advantage of the Opportunity offered in the Used Equipment Department to dispose of the equipment that you no longer need.

Will Sell Extensive Sand and Gravel Deposit

of excellent quality, consisting of 80 acres situated about six miles north of New Castle, Pa. This property has a railroad frontage of 1600 feet on the Ferona Branch of the Erie, and is located on the east bank of the Shenango River. Shipping and water facilities are unexcelled.

It occupies a territory of splendid markets and a valley that has a great future industrially.

The improvement of the Ferona Branch operated jointly with the New York Central has already been authorized and will be among the first railroad improvements to be made in this section. This construction should afford an excellent market for railroad ballast.

The deposit of sand and gravel covers largely the entire property. It lays high above the river and railroad, affording excellent facilities for gravity methods in mining. It extends from 30 to 75 feet in depth and requires but light stripping. We are offering this property at an attractive figure.

The Youngstown Construction Co.
1247 Logan Avenue Youngstown, Ohio

Talc Mines and Mill

For sale or lease, N. Y. owners cannot devote time; fully equipped, for day, night operation; adjoining and eventually will be government reservation; mineral rights protected. Fine talc deposits; suitable, sawing, grinding, large warehouse and office, at R. R.; located north Georgia. Unusual opportunity. Address

Box 1617, care of Rock Products
542 South Dearborn Street Chicago, Ill.

Who should, where should, who will, when will and where will the next cement factory be built in the United States of America, and whoever has in mind such an enterprise should write

Box 328, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

H. E. WIEDEMANN
(Est. 1905)
Consulting and Analytical Chemist

Specialist in Analysis of Rock Products
Chemical Bldg. St. Louis

George Borrowman, Ph.D.
CHEMIST

Analyses, consultations, researches in connection with rock products, cements, clays, lime, plasters, zeolites, sands, etc.

9 So. Clinton St. Chicago, Ill.

WANTED

Partner to go in with me in the sand and gravel plant. Have engine, pump and boat and an unlimited supply of the finest sand and gravel in Texas and plenty of market. Will require $15,000 to put the material on the cars.

R. O. Pearson, Colorado, Texas

WANTED

Superintendent for limestone quarry. Location, Central Illinois. Must be thoroughly competent to take full charge. State experience and salary expected. Address

Box 1623, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

Steam Shovel Operator

Opportunity for married man desiring permanent location, experienced in operation of Thew No. 0 Shovels. Silica rock quarry in western Pennsylvania. Give past employment record, ability on general repairs and monthly wage expected.

Box 1621, Care of Rock Products
542 South Dearborn Street Chicago, Ill.

WANTED

Experienced operator for Sauerman Cableway Thomas Electric Hoist. Must be capable of keeping machinery in tip-top shape. Have steady position for a good steady operator. State age, experience, and salary expected in first letter, and must be ready to come by March first. References.

J. E. IRVINE, Green River, Wyo.

Superintendent Wanted

for sand and gravel dredging plant. State experience, references and salary expected. Address

Box 1624, Care of Rock Products
542 South Dearborn Street, Chicago, Ill.

WANTED

Thoroughly experienced crushed limestone quarry superintendent, familiar with handling steam shovels, well drills, pulverizers, etc., economically. Must be sober, steady and honest, with good references, otherwise do not apply. Address

MINER CO., Limited
207 St. James Street Montreal

WANTED

Postion as superintendent, or erecting engineer; thoroughly experienced in both limestone and gravel quarries; best of references furnished.

Address Box 1618, Rock Products
542 South Dearborn Street, Chicago, Ill.

SUPERINTENDENT

desires engagement, operation of ballast or crushed stone plant. Twenty years' experience handling labor, heavy machinery, heavy blasting and large production. Familiar with all details. Excellent references.

Address Box 1613, Care Rock Products
542 S. Dearborn St., Chicago, Ill.

WANTED

Two hand packers for plaster mill; piece work. Communicate with Three Forks Portland Cement Co., Hanover, Mont., for full particulars.

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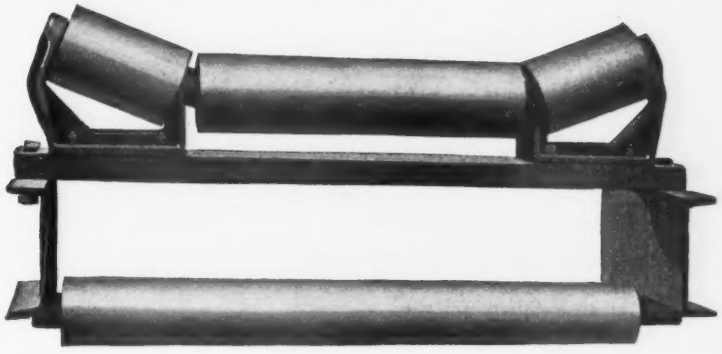

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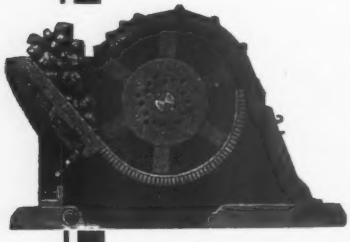

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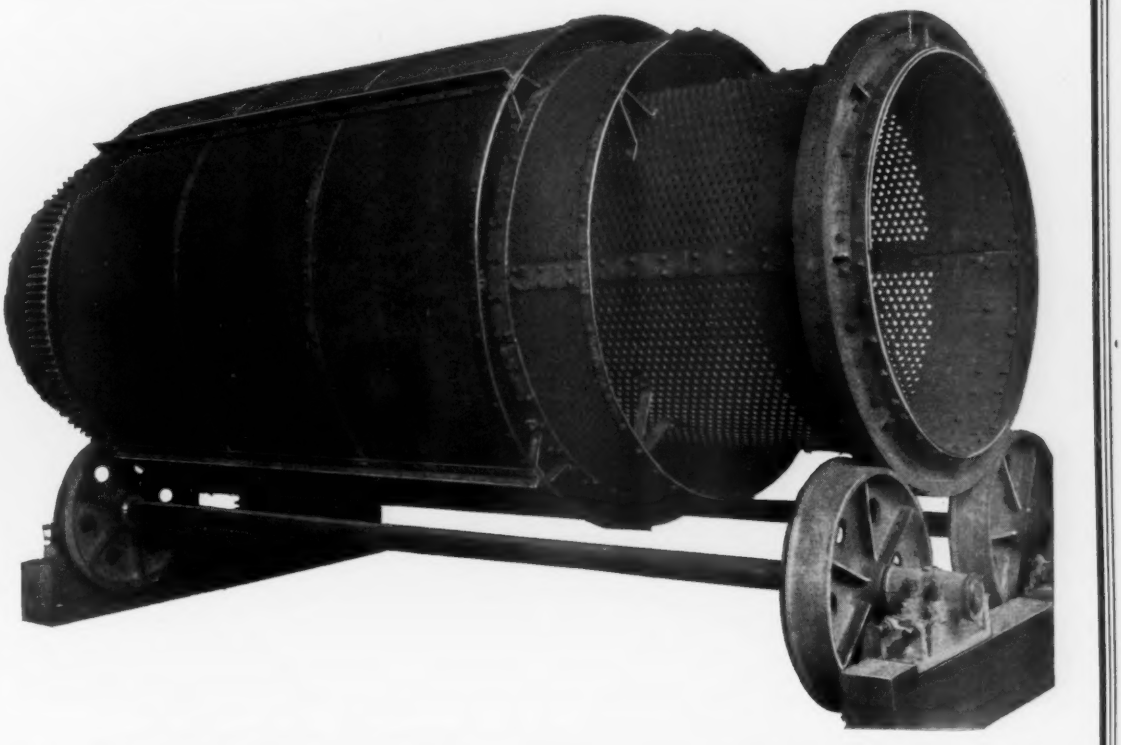

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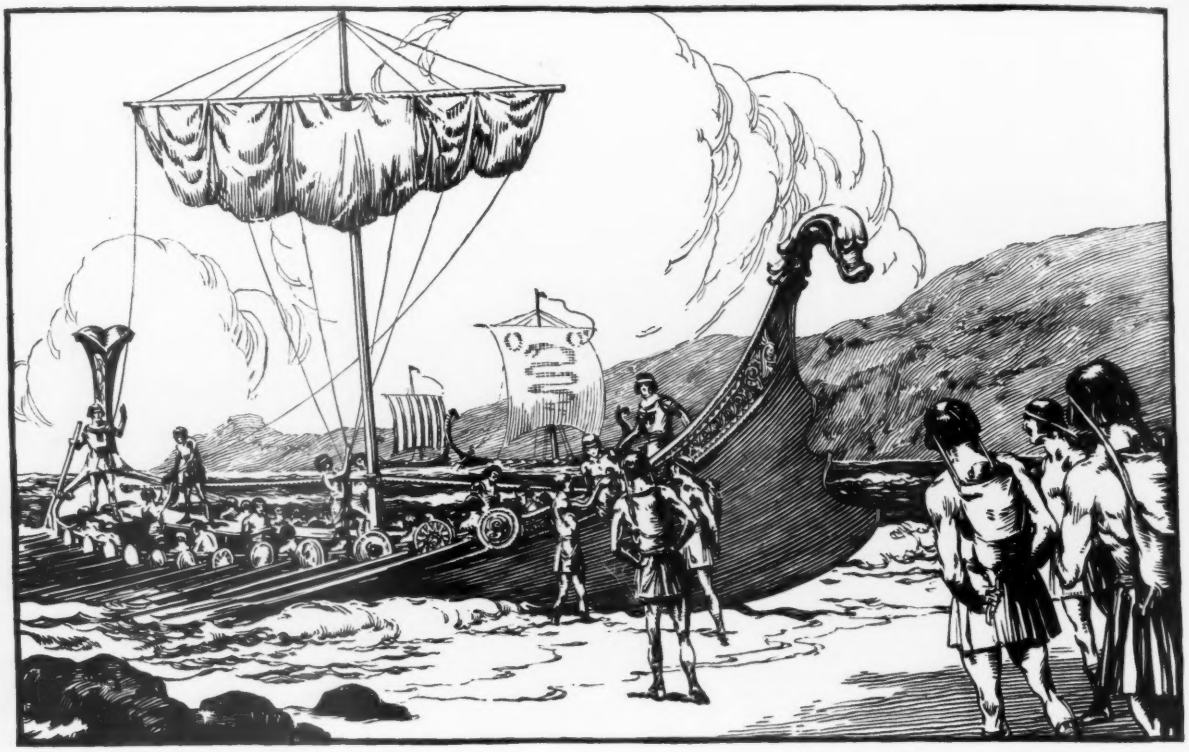

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